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A NOTE ON SOME COLEOPTERA FROM WESTMORLAND AND CUMBERLAND

Three species of Carabidae from Westmorland are omitted by Dr. B. P. Moore from his paper on the county distribution (1957, *Ent. Gaz.*, **8**: 171-172. I append notes on these species made during my short spell of collecting in 1957-1958.

Notiophilus rufipes Curtis. A strong colony among pine needles in Cliburn Moss, Westmorland (a few miles from Penrith).

Agonum quadripunctatum (Degeer). One specimen under a stone at Cliburn Moss.

Pterostichus oblongopunctatus (F.). Abundant in Glencoyne Wood, above Ullswater, where it swarms in moss and under stones.

Pterostichus cristatus Dufour. Already recorded from Cumberland, but I have found a new locality by the side of the River Irthing, near Lanercost Abbey, Cumberland.

Phymatodes testaceus (L.). Has not been recorded from Cumberland previously. A specimen was brought to me recently in oak felled locally.

W. F. DAVIDSON, F.G.S.

9 Castlegate, Penrith.

BOOK REVIEW

The Beetles of the Pacific North-west. Part 2, Staphyliniformia, by Melville H. Hatch. Seattle, 1957. pp. ix; 384. Frontis. and 37 plates. Cloth. Price in U.K. £2 15s.

This, the second part of Professor Hatch's monograph of the beetles of Pacific North America from Oregon to British Columbia, deals with the families Silphidae, Leptinidae, Leoididae, Staphylinidae, Scydmaenidae, Scaphidiidae, Clambidae, Corylophidae and Ptiliidae. The section on Scydmaenidae was compiled by Mr. G. A. Marsh, and that on Staphylinidae : Steninae by Dr. M. W. Sanderson. It is hoped to include the Pselaphidae, written up by Dr. Orlando Park, in the next volume.

Apart from the section on Staphylinidae : Steninae, the layout is much as in Part 1, with descriptions incorporated in the keys. This tends to make them unwieldy, and Dr. Sanderson's contribution, with short keys and separate descriptions, is easier to use.

The book is well illustrated and the figures of the aedeagi of *Stenus, Philonthus* and *Quedius* and the abdominal characters of *Tachinus* are particularly useful for identification. The figure of the aedeagus of *Philonthus agilis* Grav. (plate XXIV, Fig. 24), however, shows the paramere to be symmetrical instead of asymmetrical.

No comprehensive keys are given for the Staphylinidae : Aleocharinae, a subfamily badly in need of revision. There is a key to tribes and a list of species previously recorded from the region, together with a key to *Aleochara,* the only genus recorded in the tribe Aleocharini, a key to the subtribe *Liparocephalina* and descriptions of the single recorded species of *Pontomalota* and *Xenodusa.* In the last three cases there is no key to enable one to reach the subtribe or genera concerned.

Fenderia capizzi Hatch, n. gen. et sp., is described as Staphylinidae : Osoriinae but belongs to the subfamily Evaesthetinae. Some revision is also needed of generic placements in the Omaliinae, '*Acrolocha*' *megarthroides* (Fauvel), for example, being a *Hapalaraea.* From the figure of the male posterior tibia (plate XI, Fig. 10), *Acrolocha barri* Hatch, n. sp., appears to be *Hapalaraea hamatum* (Fauvel).

Nevertheless, in spite of the above criticisms, the author has made a praiseworthy attempt to bring order into a large, difficult and rather neglected group. In all, seven genera and one subgenus (all Staphylinidae) are described, together with more than 200 new species, and the work is indispensable for students of Nearctic Coleoptera of the families included.

W. O. STEEL.

NOTES ON THE COLEOPTERA OF MONKS WOOD, HUNTS.

By F. D. Buck

Through the good offices of the Nature Conservancy it was possible to work this interesting locality for three seasons, 1954-1956. The wood is just over a mile long by approximately three-quarters of a mile wide, and is damp, being very low in the centre. It consists of mixed timber, and until the Nature Conservancy undertook the management of the wood for the National Trust, on their acquisition of the area, the undergrowth was practically confined to the sides of rides and the two large clearings, West and East. These two clearings are now reverting to a type of 'grass heath' after being used for potato cultivation some six or seven years ago. Since commencing the management of Monks Wood the Nature Conservancy have begun to open up the wood in selected areas, such A_1 and U_1, resulting in an increase of herbaceous vegetation in those areas. This did not commence until the last season and therefore could have no great effect on the present notes. Any possible future work should provide an interesting comparison with the present list. Besides the three seasons' work mentioned above these notes do take into account collecting during two field meetings of the South London Entomological & Natural History Society held in the wood on 3.vi.52 and 31.v.53. The wood is well known amongst coleopterists primarily as a locality where one can be reasonably certain of obtaining *Osphya bipunctata* (F.) when the hawthorn is in blossom, and for the two large Anthribids, *Platystomus albinus* (L.) and *Platyrhinus resinosus* (Scop.), which in the experience of the writer are confined to one or two very old ash stumps in East clearing on which the *Daldinia* with which they are associated occurs.

The recordings are made on the basis of three main habitats: (1) The main rides, (2) The clearings, and (3) The glades. Three sub-divisions are made in the first of these sections: (a) The shrub and tree zone, (b) Marginal herbaceous vegetation, and (c) Terrestrial, including fallen logs and tree stumps. Further sub-divisions are made in the second section: (a) West clearing, (b) East clearing, and (c) Other clearings. The third section is not sub-divided. Months in which the species were seen or taken are indicated by Roman numerals.

Nomenclature follows Kloet, G. S. and Hincks, W. D. (1945, *A Check List of British Insects*, Stockport), except for the Carabidae, for which Moore, B. P. (1957, The British Carabidae (Coleoptera) Part I. *Ent. Gaz.*, **8**: 129-137) is taken as the authority, and the Staphylinidae, for which Tottenham, C. E. (1949, *The Generic Names of British Insects*, **1**(9): 348-466) is regarded as the authority.

Thanks are due to the Nature Conservancy for their assistance and permission to work the locality and to Dr. E. Duffey of that body who gave much help and who suggested the lines the work should take. To Mr. H. R. Last who gave assistance in determining some of the Staphylinidae; to Dr. A. M. Easton who determined some *Meligethes;* and to Prof. F. Balfour-Browne who determined the only example of Hydradephaga taken; also to Dr. J. L. Newton and Mr. R. D. Weal who gave some help collecting.

(1) THE MAIN RIDES

(a) The shrub and tree zone

Amara familiaris (Dufts.), on one occasion two or three specimens were beaten from trees, G-W, vi; *Agonum assimile* (Payk.), has been beaten from dead branches of trees, Q-G, iv; *Demetrias atricapillus* (L.), beaten from dead branches, Q-G, G-W, B-C, iv; *Dromius linearis* (Ol.), beaten from dead twigs and branches throughout the wood, v, viii; *D. quadrimaculatus* (L.), beaten from dead twigs and branches throughout the wood, iv, v, vi; *D. quadrinotatus* (Panz.), beaten from oaks, and dead twigs and branches throughout the wood, iv, v, vi; *Xylodromus depressus* (Grav.), beaten from blackthorn, B-D, v; *Quedius maurus* (Sahlb.), a single example beaten, U_1-G, vi; *Q. cruentatus* (Ol.), a single example beaten, G-W, vi; *Tachyporus obtusus* (L.) general beating throughout the wood, v, viii; *T. chrysomelinus* (L.), general beating throughout the wood, iv, v, vii; *T. hypnorum* (F.), general beating throughout the wood, iv; *T. nitidulus* (F.), general beating, Q-G, G-I, iv, v, vi; *Cantharis rustica* Fall., general beating throughout the wood, vi; *C. livida* L., quite common, general beating throughout the wood, v, vi, vii; *C. pellucida* F., beaten from hawthorn and oak throughout the wood, v, vi; *C. nigricans* (Muell.), general beating throughout the wood, v, vi; *C. cryptica* Ashe, general beating, G-B, W-V, I-H, iv, v; *C. lateralis* L., general beating, Q-G, G-B, v; *Metacantharis clypeata* (Ill.), beaten very commonly from hawthorn blossom and oak throughout the wood, v, vi; *Rhagonycha limbata* Thoms., general beating throughout the wood, v, vi; *R. lignosa* (Muell.), general beating throughout the wood, vi; *Malthinus flaviolus* (Payk.), beaten from oak, G-D, vii; *M. balteatus* Suff., beaten, I-K, vii; *M. fasciatus* (Ol.), beaten, I-K, vii; *Malthodes minimus* (L.), beaten from oak, G-D, vii; *Malachius bipustulatus* (L.), beaten from hawthorn and oak, Q-G, G-I, v, vi; *Dasytes aerosus* Kies., beaten from service blossom, oak and hawthorn blossom throughout the wood, v, vi; *Opilo mollis* (L.), beaten from hazel, though usually from dead twigs or other dead timber, a single example has been taken in a piece of dead wood very close to a pupa subsequently bred out as *Denticollis linearis* (L.), the larvae have also been found in dead wood (iv), Q-G, G-D, v; *Korynetes caeruleus* (Deg.), a single example beaten,

I-H, v; *Melanotus rufipes* (Herbst), beaten from oak and hawthorn blossom throughout the wood, v, vi; *Athous haemorrhoidalis* (F.), general beating throughout the wood, v, vi; *Adrastus nitidulus* (Marsh.), general beating, G-D, I-K, B-A, vi; *Agriotes acuminatus* (Steph.), general beating throughout the wood, v, vi, vii; *Dalopius marginatus* (L.), general beating throughout the wood, v, vi; *Denticollis linearis* (L.), beaten from hawthorn blossom, and the pupae have been taken under bark and in rotten wood, Q-G, G-B, v, vi; *Melasis buprestoides* (L.), a single example beaten, G-W, vi; *Microcara testacea* (L.), a single example beaten from oak, L-I, vi; *Megatoma undata* (L.), bred from larvae taken in old hymenopterous tunnellings, Q-U_1, larvae taken, v; *Byturus urbanus* (Lind.), beaten from hawthorn blossom throughout the wood, vi; *Meligethes atratus* (Ol.), beaten from hawthorn blossom and by general beating throughout the wood, vi, viii; *M. aeneus* (F.), (det. A. M. Easton), beaten from blackthorn throughout the wood, v; *M. picipes* Sturm (det. A. M. Easton), beaten from blackthorn, U_1-G, v; *Epurea aestiva* (L.), beaten from hawthorn blossom, also from oak, throughout the wood, v, vi; *E. unicolor* (Ol.), beaten from hawthorn blossom, I-K, vi; *E. pusilla* (Ill.), a single example from hawthorn blossom, G-W, vi; *E. melanocephala* (Marsh.), beating hawthorn, Q-G, G-D, I-K, vii; *E. deleta* Sturm, beaten from blackthorn blossom, G-B, v; *E. rufomarginata* (Steph.), beaten from blossom and at sap, B-C, iv, v; *Soronia grisea* (L.), beaten from dead twigs, at B, v; *Librodor hortensis* (Geof.), beaten from oak and a single example beaten from hawthorn blossom, G-W, v, vi; *Cryptophagus dentatus* (Herbst), beaten from hawthorn blossom, G-B, v, vi; *Antherophagus nigricornis* (F.), beaten from an oak, Q-G, vii; *Olibrus aeneus* (F.), general beating, G-I, vi; *Stilbus testaceus* (Panz.), general beating, G-I, viii; *Lathridius lardarius* (Deg.), general beating, Q-G, vii; *Enicmus transversus* (Ol.), general beating, Q-G, vii; *Corticarina gibbosa* (Herbst), general beating throughout the wood, v, vi; *Adalia bipunctata* (L.), general beating throughout the wood, v, vi, vii, viii; *A. decempunctata* (L.), general beating throughout the wood, v, viii; *Coccinella septempunctata* (Pont.), general beating throughout the wood, iv, v, vi, vii, viii; *Calvia quattuordecimguttata* (L.), general beating throughout the wood, iv, v, vi; *Prophylea quattuordecimguttata* (L.), general beating throughout the wood, vi, vii; *Anatis ocellata* (L.), a single example beaten from hawthorn, B-C, v; *Exochomus quadripustulatus* general beating, Q-G, A-C, v, vi; *Hedobia imperialis* (L.), beaten from old twigs, U_1-G, v; *Grynobius excavatus* (Kug.), beaten from dead branches throughout the wood, v; *Anobium fulvicorne* Sturm, quite common by beating dead twigs and branches, though specimens do come off live branches, throughout the wood, vi, vii; *Oedemera nobilis* (Scop.), a female beaten from hawthorn blossom, B-D, v; *Ischnomera coerulea* (L.), beaten from hawthorn blossom, I-K, L-W, v; *Vincenzellus viridipennis*

(Lat.), beaten from dead twigs, I-K, v; *Pyrochroa serraticornis* (F.), beaten from hawthorn blossom, Y-D, B-A, v, vi; *Mordellistena abdominalis* (F.), beaten from hawthorn blossom, also a single example from oak, G-B, vi; *Anaspis frontalis* (L.), very common, general beating, mainly hawthorn and service blossom throughout the wood, v, vi, vii; *A. maculata* Geof., probably even more plentiful than the foregoing, beaten from hawthorn and service blossom wherever these trees occur, v, vi, vii; *A. rufilabris* Gyll., general beating, mainly on hawthorn blossom throughout the wood, v, vii; *A. regimbarti* Schil., beating hawthorn blosson throughout the wood. v, vi; *A. costae* Emery, beating hawthorn blossom not yet in bloom, U-U_1, v; *Orchesia minor* Walk., a single example beaten from an ash on which there was several small *Daldinia concentrica* Ces & de Nat., U_1-G, v; *Conopalpus testaceus* (Ol.), a single example beaten from oak, G-W, vii; *Osphya bipunctata* (F.), beaten from hawthorn blossom, common throughout the wood, v, vi; *Rhagium mordax* (Deg.), beaten from hawthorn blossom, and both imagines and larvae have been found under the bark of fallen trees, W-I, iv, v; *Stenochorus meridianus* (L.), general beating (including the black form) throughout the wood, v; *Grammoptera ruficornis* (F.), general beating, particularly hawthorn blossom, throughout the wood, v, vi, vii; *G. holomelina* Pool, beaten from oak and hawthorn blossom, G-W, B-C, v; *Alosterna tabacicola* (Deg.), from hawthorn and by general beating, G-D, I-K, v, vi; *Strangalia maculata* Poda, a single example beaten from hazel, Q-U_1, vii; *S. melanura* (L.), general beating, Q-G, G-B, vi; *Molorchus umbellatarum* Schr., a single example beaten from dead twigs, G-U_1, vi; *Anaclyptus mysticus* (L.), general beating, particularly hawthorn blossom throughout the wood, v, vi; *Pogonochaerus hispidulus* (Pill. & Mitt.), general beating, Q-G, v; *P. hispidus* (L.), beaten from dead branch, Q-G, iv; *Tetrops praeusta* (L.), general beating, particularly hawthorn blossom, B-A, vi; *Donacia versicolorea* (Brahm), a single example beaten from oak, Q-U_1, this specimen was probably from a pond near by, vi; *Phytodecta decemnotata* (Marsh.) (*rufipes* Deg.), beaten in numbers from aspens, G-D, vii; *P. viminalis* (L.), in numbers on sallow, G-B, also the variety *10-punctata* L., vi; *Lochmaea crataegi* (Forst.), beaten from hawthorn blossom throughout the wood, v, vi; *Aphthona euphorbiae* (Schr.), general beating throughout the wood v; *Chalcoides aurea* (Geof.), beating hawthorn, aspen and sallow throughout the wood, v, vi; *Bruchus affinis* Froe., beaten from hawthorn blossom, U_1-K, v; *Lasiorhynchus cavifrons* (Gyll.), beaten from oak, Q-G, G-W, vi; *Caenorhinus germanicus* (Herbst), beaten from oak, G-W, vi; *C. aequatus* (L.), beating hawthorn throughout the wood, v, vi; *Rhynchites caeruleus* (Deg.), beaten from hawthorn just coming into leaf, G-B, iv; *Attelabus nitens* (Scop.), beaten from oak, G-D, vii; *Apoderus coryli* (L.), beaten from hazel, Q-G, A-B, mainly in single

examples, v, vi; *Apion pomonae* (F.), quite common by general beating throughout the wood, iv, v, vi; *A. ervi* Kirby, a single example beaten, G-W, v; *Phyllobius oblongus* (L.), general beating, Q-G, G-D, A-C, v, vi; *P. maculicornis* Germ., quite common general beating, Q-G, G-D, I-K, vi; *P. argentatus* (L.), general beating throughout the wood, v; *Polydrusus pterygomalus* Boh., general beating throughout the wood, vi, vii; *P. cervinus* (L.), general beating throughout the wood, v, vi; *Sciaphilus asperatus* (Bons.), beaten from hawthorn blossom and also from hawthorn just coming into leaf, G-B, iv, v; *Strophosomus subrotundus* (Marsh.), general beating, Q-U_1, G-D, A-B, vii; *Barynotus moerens* (F.), in numbers on *Mercurialis perennis* L., G-M, v; *Sitona lineatus* (L.), general beating throughout the wood, iv, v; *Dorytomus dejeani* Faust., beaten from sallow and aspen, G-B, vi; *Anthonomus pedicularis* (L.), beaten from hawthorn blossom, G-D, B-C, v; *A. pomorum* (L.), beaten from crab apple, v; *A. rubi* (Herbst), general beating throughout the wood, v; *Curculio* (*Curculio*) *nucum* L., general beating, mainly hazel, Q-U_1, G-D, vii; *C.* (*C.*) *glandium* Marsh., a single example from oak, G-W, v; *C.* (*Balanobius*) *pyrrhoceras* Marsh., general beating, particularly sallows, throughout the wood, v, vi; *Rhynchaenus alni* (L.), general beating, Q-U_1, vii; *R. quercus* (L.), general beating, mainly hawthorn blossom and oak, throughout the wood, iv, v; *R. fagi* (L.), general beating, throughout the wood, v; *R. stigma* Germ., beaten from blossom, G-M, v.

(b) MARGINAL HERBACEOUS VEGETATION

Tachyporus chrysomelinus (L.), sweeping rides on edges of U_1, viii; *T. nitidulus* (F.), sweeping G-M, and edges of U_1, viii; *Microcara testacea* (L.), swept, G-M, vii; *Kateretes pedicularis* (L.), sweeping, G-M, vii; *Glischrochilus quadripunctatus* (L.), a single example swept, G-M, vii; *Adalia bipunctata* (L.), sweeping, Q-G, G-W, vi; *A. decempunctata* (L.), sweeping, Q-G, G-W, vi; *Coccinella septempunctata* L., sweeping edges of U_1, vi; *C. undecimpunctata* L., sweeping, G-M, vii; *Propylea quattuordecimpunctata* (L.), sweeping, Q-G, G-W, vi; *Antherophagus nigricornis* (F.), sweeping edges of U_1 and on G-M, vii; *Lema melanopa* (L.), sweeping, G-M, vii; *Chrysolina polita* (L.), quite common sweeping, G-M, vii; *Chaetocnema concinna* (Marsh.), also quite common sweeping, G-M, and edges of U_1, vii; *Mordellistena humeralis* (L.), two examples swept, G-M, one of which was the var. *axillaris* Gyll., vii; *Apion onopordi* Kirby, swept from thistles, G-M, and on edge of U_1, vi; *A. hydrolapathi* (Marsh.), swept from *Rumex*, Q-G, vi; *Sitona lineatus* (L.), swept, G-M, vi; *Miccotrogus picirostris* (F.), swept, G-M, vi; *Cionus scrophulariae* (L.), on *Scrophularia aquatica* L., Q-G, and edges of U_1, vi; *C. hortulanus* (Geof.), as above, vi; *Rhinoncus pericarpius* (L.), sweeping on ride L near U_1, vii.

(c) TERRESTRIAL (INCLUDING VEGETABLE REFUSE, TREE STUMPS AND LOGS)

Leistus spinibarbis (F.), under logs, U_1-G, G-W, vii; *Nebria brevicollis* (F.), under stones, pieces of board, logs, etc., U-U_1, U_1-M, G-B, I-K, B-A, iv, v; *Notiophilus biguttatus* (F.), in vegetable refuse, Q-G, vii; *N. substriatus* Waterh., running on ground particularly in sunshine, Q-G, G-B, v; *N. palustris* Dufts., in vegetable refuse, Q-G, vii; *Bembidion lunulatum* (Dufts.), in damp spots, G-B, v, vi; *B. lampros* (Herbst), on bare patches of ground, v, vi; *Asaphidion flavipes* (L.), running on ground, G-D, iv, v; *Harpalus affinis* (Schrank), under stones, etc., U-U_1, G-F, I-H, B-C, viii; *Stomis pumicatus* (Panz.), under stones and in vegetable refuse, U-U_1, Q-G, iv, vi; *Pterostichus cupreus* (L.), a single example under a stone on two separate occasions, U-U_1, v, viii; *P. madidus* (F.), under stones, boards, logs, etc., U_1-L, G-F, A-E, iv, v, viii; *P. strenuus* (Panz.), commonly in vegetable refuse, Q-U_1, vi, viii; *Abax parallelopipidus* (Pill & Mitt.), under stones, logs, etc., U-U_1, v, viii; *Agonum assimile* (Payk.), under stones, logs, etc., Q-M, G-D, I-H, B-A, S-QG, iv, v, viii; *Dromius melanocephalus* Dej., in vegetable refuse, Q-U_1, vii; *Cercyon atomarius* (F.), one example in vegetable refuse, Q-U_1, iv; *Megasternum obscurum* (Marsh.), in vegetable refuse, Q-U_1, vi; *Necrophorus humator* (Goeze), under carrion, Q-U_1, B-A, iv, v; *Phosphuga atrata* (L.), under bark of fallen trees and under stones, etc., Q-U_1, B-C, iv; *Catops fuscus* (Panz.), in rabbit carcase, B-C, iv; *C. chrysomeloides* (Panz.), with above, iv; *Agathidium laevigatum* Er., a single example in vegetable refuse, Q-U_1, vi; ? *Acrotrichis intermedia* Gill., very common in vegetable refuse, Q-U_1, vi; *Micropeplus staphylinoides* (Marsh.), in vegetable refuse, Q-U_1, iv; *Pseudopsis sulcata* Newm., in vegetable refuse, U-U_1 viii; *Metopsia clypeata* (Muell.), in vegetable refuse, Q-U_1, viii; *Proteinus ovalis* Steph., in numbers in carcase of rabbit and in carcases on old gamekeeper's gibbet, Q-U_1, B-C, iv; *Omalium rivulare* (Payk.), in rabbit carcase, B-C, vi; *O. caesum* Grav., (det. H. R. Last), in vegetable refuse, Q-U_1, vi; *Anthobium atrocephalum* (Gyll.), in rabbit carcase, B-C, vi; *Oxytelus sculpturatus* Grav., a single example in vegetable refuse, Q-U_1, vi; *O. rugosus* (F.), in vegetable refuse, Q-U_1, viii; *Stenus clavicornis* (Scop.), in vegetable refuse, Q-U_1, viii; *S. melanopus* (Marsh.), in vegetable refuse, Q-U_1, viii; *S. brunnipes* Steph., in vegetable refuse, Q-U_1, v, viii; *S. subaeneus* Erich., in vegetable refuse, Q-U_1, viii; *S. pallipes* Grav., in vegetable refuse, Q-U_1, vi; *S. flavipes* Steph., in vegetable refuse, Q-U_1, viii; *S. nitidiusculus*, in vegetable refuse, Q-U_1, viii; *Astenus pulchellus* (Heer), in vegetable refuse, Q-U_1, viii; *Rugilis rufipes* (Germ.), quite common in vegetable refuse, Q-U_1, vi, viii; *Xantholinus longiventris* Heer, under bark of fallen tree Q-G, iv; *Gyrohypnus punctulatus* (Goeze), a single example in vegetable refuse, Q-U_1, vi; *Philonthus decorus* (Grav.), in rabbit carcase, B-C, iv; *P. marginatus* (Strøm),

in large numbers in rabbit carcase, B-C, iv; *P. umbratilis* (Grav.), in rabbit carcase, B-C, iv; *P. varians* (Payk.), in rabbit carcase and other carrion, Q-U_1, B-C, iv, vi; *Gabrius splendidulus* (Grav.), under bark of fallen tree, Q-G, iv; *Ocypus brunnipes* (F.), at base of a pile of vegetable refuse, Q-U_1, viii; *Heterothops dissimilis* (Grav.), in vegetable refuse, Q-U_1, viii; *Quedius picipes* (Man.), in vegetable refuse, Q-U_1, viii; *Q. fumatus* (Steph.), in vegetable refuse, Q-U_1, viii; *Q. nemoralis* Baudi, in vegetable refuse, Q-U_1, viii; *Habrocerus capillaricornis* (Grav.), in vegetable refuse, Q-U_1, vi, viii; *Conosomus testaceus* (F.), in vegetable refuse, Q-U_1, vi, viii; *C. immaculatus* (Steph.), in vegetable refuse, Q-U_1, vi, viii; *C. pedicularis* (Grav.), in vegetable refuse, Q-U_1, vii; *Tachyporus obtusus* (L.), in vegetable refuse throughout the wood, v, viii; *T. chrysomelinus* (L.), in vegetable refuse and heaps of sticks throughout the wood, iv, v, viii; *T. hypnorum* (F.), in the same situations as the preceding species throughout the wood, iv, v; *T. nitidulus* (F.), in vegetable refuse, heaps of sticks and other rubbish, Q-G, iv, v, vi; *Cilea silphoides* (L.), in vegetable refuse, Q-U_1, vii; *Hygronoma dimidiata* (Grav.), (det. H. R. Last), in vegetable refuse, Q-U_1, vii; *Leptusa fumida* (Erich.), (det. H. R. Last), in vegetable refuse, Q-U_1, iv; *Bolitochara bella* Maerk., in fungus, G-W, iv; *Callicerus rigidicornis* (Erich.), in damp vegetable refuse, Q-U_1, viii; *Atheta* (*Tetropia*) *trinotata* (Kraatz), (det. H. R. Last), in vegetable refuse, Q-U_1, iv, vi, viii; *A.* (*Acrotona*) *fungi* (Grav.), (det. H. R. Last), in vegetable refuse, Q-U_1, iv, viii; *Aleochara curtula* (Goeze), in carrion on gamekeeper's gibbet, Q-U_1, vi; *A. lanuginosa* Grav., in vegetable refuse, Q-U_1, viii; *A. bipustulata* (L.), in vegetable refuse, Q-U_1, viii; *Saprinus semistriatus* (Scriba), under carcase, Q-U_1, vi; *Lampyris noctiluca* (L.), an almost full-grown larva under a stone, B-A, v; *Dermestes murinus* L., in carcases, Q-U., v, vi; *Nitidula bipunctata* (L.), in carcases on gamekeeper's gibbet, Q-U_1, v, vi; *Omosita discoidea* (F.), in carcases on gamekeeper's gibbet, Q-U_1, iv, vi; *Cryptophagus pilosus* Gyll., in vegetable refuse, Q-U_1, vi, viii; *C. dentatus* (Herbst), in vegetable refuse, Q-U_1, v, vi; *Enicmus minutus* (L.), common in vegetable refuse, Q-U_1, vi; *E. transversus* (Ol.), in vegetable refuse, Q-U_1, viii; *Corticaria pubescens* (Gyll.), commonly in vegetable refuse, Q-U_1, vi, viii; *Aphodius prodromus* (Brahm), in gut of dead rabbit, B-C, vi; *Sinodendron cylindricum* (L.), the remains of a single example in a tree stump, Q-G, v; *Rhagium mordax* (Deg.), imagines and larvae under bark of a fallen tree, Q-G, iv; *Chaetocnema concinna* (Marsh.), in vegetable refuse, Q-U_1, viii; *Apion dichroum* Bedel, a single example in vegetable refuse, Q-U_1, vii.

(2) THE CLEARINGS

(a) West Clearing

Nebria brevicollis (F.), under stones, pieces of board, logs, etc., iv, v; *Notiophilus substriatus* Waterh., running on bare patches of

ground, v; *Clivina fossor* (L.), on damp ground and mud at roots of rushes at eastern end, v, viii; *Bembidion lunulatum* (Geof.), common on mud in damp situations, vii; *B. genei* var. *illigeri* Netol., in same situations as above, vii, viii; *B. guttula* (F.), in tufts and in damp places at eastern end, viii; *B. lampros* (Herbst), on marshy ground at eastern end and running on bare patches of ground, v, vi; *Harpalus affinis* (Schrank), under stones, etc., viii; *Pterostichus madidus* (F.), under stones, logs, etc., v, viii; *P. strenuus* (Panz.), in turves in damp places, vi, viii; *Odontonyx rotundatus* (Payk.), on muddy ground at roots of vegetation at eastern end, v; *Agonum assimile* (Payk.), under stones, logs, etc., viii; *A. viduum* var. *moestum* (Dufts.), in damp places and in grass tufts, v, vi, viii; *Hydroporus tessellatus* Drap., (det. Prof. F. Balfour-Browne), in small rain pools, v; *Limnebius truncatellus* (Thunb.), a single example in a shallow pool at the eastern end, v; *Helophorus* (*Megalelophorus*) *aquaticus* (L.), in small shallow pools at eastern end, v; *H.* (*H.*) *flavipes* F., in same situation as preceding species, v; *H.* (*H.*) *minutus* F., in tufts in damp places and small shallow pools at eastern end, v; *Megasternum obscurum* (Marsh.), in tufts in damp situations, vi, vii; *Hydrobius fuscipes* (L.), in small shallow pools at eastern end, v; *Anacaena globulus* (Payk.), in tufts in damp situations, viii; *Carpelimus rivularis* (Mots.), on mud in damp situations and about roots of plants in these situations, vii; *Platystethus capito* Heer, on muddy ground around rain pools, v; *Stenus clavicornis* (Scop.), sweeping in damp places, sometimes found running on mud or can be trodden out of the roots of vegetation in muddy places, vii; *S. rogeri* Kraatz, in vegetable refuse and on marshy ground, v, vii; *S. brunnipes* Steph., on marshy ground, v, viii; *Lathrobium geminatum* Kraatz, on an old sack, iv; *L. brunnipes* (F.), on damp ground and in grass tufts on damp ground at eastern end, v; *L. longulum* Grav., on edges of puddles and on marshy ground, v; *Neobisnius procerulus* (Grav.), in same situations as previous insect, vii; *Tachyporus nitidulus* (F.), general beating, v, vi; *Tachinus signatus* (Grav.), a single example on damp ground at eastern end, v; *Cantharis cryptica* Ashe, general beating, v; *C. lateralis* L., general beating, v; *Metacantharis clypeata* (Ill.), general beating, v, vi; *Rhagonycha limbata* Thoms., general beating, v, vi; *R. lignosa* (Muel.), general beating, vi; *Dasytes aerosus* Kies., general beating, v; *Melanotus rufipes* (Herbst), general beating, v, vi; *Athous haemorrhoidalis* (F.), general beating, vi; *Agriotes acuminatus* (Steph.), general beating, vii; *Adrastus nitidulus* (Marsh.), general beating, also by sweeping, vi; *Stilbus testaceus* (Panz.), in tufts in damp places at eastern end, iv, v, viii; *Coccidula rufa* (Herbst), in damp places, v; *Adalia bipunctata* (L.), general beating and sweeping, vi, viii; *A. decempunctata* (L.), general beating and sweeping, vi, vii; *Rhagium mordax* beaten from hawthorn blossom, v; *Saperda populnea* (L.), on aspens, v; *Phytodecta decemnotata* (Marsh.), in numbers on aspen, vii; *P. rufipes* Deg., on aspen,

vi; *Haltica oleracea* (L.), common on marshy ground at eastern end, v; *Chalcoides aurea* (Geof.), on aspen, v, vi; *C. fulvicornis* (F.), on aspen, v, vi; *Deporaus betulae* (L.), general beating, v; *Phyllobius oblongus* (L.), general beating, v, vi; *P. argentatus* (L.), general beating, v; *Polydrusus pterygomalus* Boh., general beating, v; *P. cervinus* (L.), general beating, vi; *Sitona lineatus* (L.), general beating and sweeping, iv, v; *Dorytomus dejeani* Faust., beaten from sallow and aspen, vi; *Anthonomus rubi* (Herbst), general beating, v, vi; *Curculio* (*Balanobius*) *pyrrhoceras* Marsh., general beating, v, vi; *Ceuthorrhynchus contractus* (Marsh.), in tufts in damp situations, viii; *Rhynchaenus quercus* (L.), general beating, iv, v; *R. fagi* (L.), general beating v.

(b) East Clearing

Cicindela campestris L., a single example in an open part of the clearing, v; *Carabus nemoralis* Muel., a single example under a log, v; *Notiophilus substriatus* Waterh., running on bare patches of ground, v; *Bembidion lunulatum* (Fourc.), on marshy ground and damp places, v, vi; *B. lampros* (Herbst), on marshy ground and damp places, also running on bare patches of ground, v, vi; *B. quadrimaculatum* (L.), in same situations as preceding species, v; *Harpalus affinis* (Schrank), under stones, etc., viii; *Pterostichus madidus* (F.), under stones, boards, etc., iv, viii; *Abax parallelopipedus* (Pill. & Mitt.), under log, vi; *Agonum assimile* (Payk.), under stones, logs, etc., v, viii; *A. dorsale* (Pont.), under stones, etc., vii; *Lebia chlorocephala* (Hoff.), a single example running on ground at entrance, vi; *Scaphosoma agaricinum* (L.), under fungus on old ash stump, v; *S. boleti* (Panz.), one example on old tree stump, v; *Ocypus olens* (Muell.), under stones, boards, etc., iv; *Quedius cruentus* (Ol.), a single example under a log, v; *Atheta* (*Tetropla*) *trinotata* (Kraatz), (det. H. R. Last), in fungus, vi; *A.* (*Dimetrota*) *atramentaria* (Gyll.), (det. H. R. Last), in fungus, iv; *A.* (*Acrotona*) *fungi* (Grav.), (det. H. R. Last), in vegetable refuse, iv; *Cantharis cryptica* Ashe, general beating, v; *Metacantharis clypeata* (Ill.), general beating, v, vi; *Rhagonycha limbata* Thoms., general beating, vi; *R. lignosa* (Muell.), general beating, vi; *Dasytes aerosus* Kies., general beating, v; *Melanotus rufipes* (Herbst), general beating, vi; *Athous haemorrhoidalis* (F.), general beating, v; *Agriotes obscurus* (Steph.), sweeping, vii; *Adrastus nitidulus* (Marsh.), beating, vi; *Adalia bipunctata* (L.), general beating and sweeping, vi, vii; *A. decempunctata* (L.), also general beating and sweeping, vi, vii; *Sinodendron cylindricum* (L.), a single example and the remains of another were found in a very old ash log in the N.E. corner of the clearing, vi; *Chalcoides aurea* (Geof.), on aspen, v, vi; *Platystomus albinus* (L.), on very old ash stump in and around *Daldinia concentrica* Ces & de Not., v, vi. vii; *Platyrhinus resinosus* (Scop.), in same situation as above, v, vii; *Apion minimum* Herbst, a single example beaten from sallow, vi;

A. simile Kirby, general beating, v; *Polydrusus pterygomalus* Boh., general beating, vi; *P. cervinus* (L.), general beating, v.

(c) OTHER (SMALLER) CLEARINGS

Agonum assimile (Payk.), several under bark of stump in new clearing, G., vi; *Conosomus testaceus* (F.), a single example in an old stump, U_1, v; *Tachyporus chrysomelinus* (L.), general sweeping, U_1, vii; *T. nitidulus* (F.), general sweeping, U_1, vii; *Cantharis rustica* Fall., general beating, A_1, U_1, and G_1, vi; *C. livida* L., general beating, U_1, vii; *C. pellucida* F., general beating, G_1, v; *C. nigricans* (Muell.), general beating in most clearings, v, vi; *C. cryptica* Ashe, general beating, A_1, v; *C. lateralis* L., general beating, U_1, v; *Metacantharis clypeata* (Ill.), general beating, A_1 and G_1, vi; *Rhagonycha limbata* Thoms, general beating, U_1, vi; *R. lignosa* (Muell.), general beating, A_1, vi; *Dasytes aerosus* Kies., general beating, v; *Melanotus rufipes* (Herbst), general beating, P, vi; *Athous haemorrhoidalis* (F.), general beating, A_1, U_1, G_1, and B_1, v, vi; *Agriotes acuminatus* (Steph.), sweeping, U_1, A_1, vii; *Adrastus nitidulus* (Marsh.), beating and sweeping, U_1, v, vi; *Rhizophagus bipustulatus* (F.), under bark of stumps of newly felled trees, G_1, vi; *Coccinella septempunctata* L., general sweeping and beating hazel and birch scrub, U_1, vi, vii; *Adalia bipunctata* (L.), general beating in almost any clearing, vi, vii; *A. decempunctata* (L.), general beating and sweeping in almost any clearing, vi, vii; *Cis boleti* (Scop.), in fungus on fallen tree trunk, U_1, iv, v; *Antherophagus nigricornis* (F.), a single example swept in U_1, vii; *Chaetocnema concinna* (Marsh.), sweeping, U_1, vi; *Deporaus betulae* (L.), on birch in U_1, vi; *Barypithes araneiformis* (Schrank), sweeping, U_1, vii; *Sitona lineatus* (L.), general beating and sweeping, A_1, G_1, and U_1, iv, v; *Rhynchaenus fagi* (L.), general beating, U_1, v; *Anthonomus rubi* (Herbst), general beating, U_1, vi; *Curculio* (*Balanobius*) *pyrrhoceras* Marsh., general beating, vi; *Rhinoncus pericarpius* (L.), sweeping, U_1, vii; *Cionus scrophulariae* (L.), on *Scrophularia aquatica* L., U_1, vi; *C. hortulanus* (Geof.), as above, vi.

(3) THE GLADES

Pterostichus madidus (F.), under logs, L-I, v; *Xantholinus longiventris* Heer, under bark of fallen tree, L-I, iv; *Gabrius splendidulus* (Grav.), under bark of fallen tree, L-I, iv; *Bolitochara bella* (Maerk.), in fungus, L-I, iv; *Dermestes murinus* L., under carcase, L-I, vi; *Adrastus nitidulus* (Marsh.), sweeping, L-I, vi; *Mycetochara humeralis* (F.), a single example beaten from a dead twig, L-I, vi; *Rhagium mordax* (Deg.), imagines and larvae under bark of fallen tree, L-I, iv; *Chrysolina polita* (L.), a single example on *Mercurialis perennis* L., L-I, v; *Phytodecta decemnotata* (Marsh.), (*rufipes* Deg.), very common on aspen, L-I, vi; *Chalcoides aurea* (Geof.), on aspen, L-W, vi; *Galerucella tenella* (L.), beaten from aspen, L-W, vi; *Dorytomus taeniatus* (F.), common on aspen, L-I, vi; *D. dejeani* Faust., as above,

MONKS WOOD
Stream
Stream
Stream
West Clearing
East Clearing
aspens
Hut
To Wood Walton
Walton Hill
N
To Alconbury
To Abbots Ripton
Wood Boundary
0 125 250 375 500
YARDS

vi; *Phyllobius argentatus* (L.), general beating in almost any glade, v, vi; *Polydrusus cervinus* (L.), general beating in almost any glade, v, vi; *P. pterygomalus* Boh., general beating in almost any glade, v. vi; *Sitona lineatus* (L.), general beating, L-I, iv; *Rhynchaenus fagi* (L.), general beating, L-I, B-A_1, v; *Anthonomus rubi* (Herbst), general beating, B-A_1, v; *Curculio* (*Balanobius*) *pyrrhoceras* Marsh., general beating, B-Y, Y-C, vi.

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RECENT LITERATURE

Coleoptera of Somerset, by W. A. Wilson, 1958. Somersetshire Archæological and Natural History Society. Supplement to Proceedings Vols. 101 and 102. pp. (4); 167; (7). Wrappers. Price 10s. 6d.

It is good to see modern, well-produced local lists of Orders other than Lepidoptera. We have no anti-Lepidoptera bias, but, as anyone knows who has made the attempt, it is no easy thing to find a publisher for a list as extensive as the present one—which one knows in advance must have a very restricted sale. We notice that a Royal Society Grant of £150 was made towards the cost of the publication and we feel that the governmental grant in aid is being put to wise use in such cases as this. It is worthy of note that the list is of wider interest than its title denotes as it is remarked in the Preface that 'The distribution notes do not relate specifically to Somerset, but cover the Southern counties of England as a whole'.

E.W.C.

100 YEARS AGO

In *The Entomologist's Annual* for 1859 was published a 'List of British Entomologists'.

This list included 967 names—a very large number when one considers that at that time all entomologists were amateurs.

One hundred and eight species of Coleoptera were added to the British List in 1858 and are listed by E. W. Janson.

Of the 25 Lepidoptera brought forward by H. T. Stainton as 'New British Species in 1858', no less than 15 are 'Tineina', which is an indication of the interest in this group at that time—mainly through the impetus imparted by the enthusiasm of Stainton himself.

A NOTE ON *SPAELOTIS RAVIDA* (SCHIFF) (LEP., CARADRINIDAE)

Mr. R. F. Bretherton in his fascinating synopsis of the history of this species (1957. *Ent. Gaz.*, **8**: 3-19) points out that nothing has been recorded of the egg and early larval instars: indeed, that recent attempts to obtain fertile eggs have always been unsuccessful. It seems, therefore, that it might be useful to describe in some detail an attempt which came near to success, in case a study of my errors might help another to avoid them.

A worn *S. ravida* female was taken in my garden on the night of Sept. 3/4th 1958 and was put into a three-inch glass-bottomed box. On the night of Sept. 5/6th 5 eggs were laid, about 150 on the next day, and a further 50 to 60 on Sept. 9th. The first eggs were laid on the sides of the box, and the second batch partly in ones, twos and threes on the sides, but mainly in heaps of up to 20 in the angle formed by the side and bottom of the box, as were the third batch.

The egg when freshly laid was hemispherical, and of a pale yellow colour. It was glossy, and appeared smooth. After several days it could be seen that it was lightly ribbed.

Having had a previous failure with eggs of this species kept indoors in a warm room (they collapsed in a very short time) I decided to keep this batch out of doors, and reasonably humid. They were placed in the shade, near the door of an out-house, with a piece of damp cotton wool in the box.

On Sept. 16th, about one-quarter of the eggs were slightly darker. The others were beginning to collapse. The darkening increased steadily, until by Sept. 25th they were of a dark straw colour.

On Sept. 28th several had made a complete colour change, to an opaque pale grey, with the larval head and body visible inside. On the following day, all the eggs presumed alive had changed colour, and by Sept. 30th all were of a glossy dark grey, lightly marbled. I think that it was on this day that they died. By the next morning many were beginning to collapse, and turn black.

Probably I came very near to success. It occurs to me to wonder why so few eggs darkened. Perhaps this insect has to mate several times to ensure full fertility. It would also seem that the eggs need certain conditions of temperature and humidity for survival. This may be in some part the reason for its fluctuations in status over the past century. I must leave these points to others better qualified to pronounce on them, and content myself with supplying a little additional data.

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THE BIBLIOGRAPHIES OF ORDERS IN THE REVISED EDITION OF IMMS'S *A GENERAL TEXTBOOK ON ENTOMOLOGY*: SOME CRITICISMS AND SUGGESTIONS

By RICHARD CURLE

As was inevitable, the bibliographies attached to the sections on the larger Orders in the new edition, revised by Richards & Davies, of Imms's classic work *A General Textbook of Entomology*, are highly selective. For not only is the literature enormous—according to the Editors 'about 4,000 papers and books on insects now appear annually'—but advances in knowledge are constantly making works, once standard, either obsolescent or completely outmoded. Comprehensive, uncritical bibliographies which embrace everything, the old and the new, the good and the bad, have their place; but in bibliographies intended to benefit students those writings alone which are up-to-date and immediately helpful serve any vital purpose.

And in this respect (I am speaking of the books and pamphlets in English) the Editors of the new 'Imms' have fulfilled their task with admirable courage. They have kept their objective steadily before them and have rigorously excluded what was not essential, even if it has meant dropping long-established works by such entomologists, amongst others, as H. Denny, Buckton and Lubbock. But as selection depends finally upon individual choice, and as, even in this narrowed field, the range is immense, books have been ignored that I, personally, feel might have warranted a notice. And, of course, some books of primary consequence have been published since 1952, after which date, to quote from the Preface, 'we have not attempted systematically to cover the literature', although 'some later information has, in fact, been included'.

Let me clarify my contention by examples. There is no entry of Meyrick's *Exotic Microlepidoptera* which, in its detailed treatment of a difficult subject, is both pioneer and significant. Issued between 1912 and 1937 in eighty-five Parts (the R.E.S. added a supplementary list by Meyrick in 1939 'communicated by T. Bainbrigge Fletcher') which, with the unpublished final Part, would have formed a monograph of four and a quarter volumes, it treats of a branch of entomology much neglected until fairly recently.

I am rather surprised that none of Evans's three Catalogues of the African, European-Asian-Australian, and American Hesperiidae finds a place in the bibliography. They are modern works by a recognized authority and are worthy of attention. (It is true that the last two of the four Parts of the American volume appeared

after 1952, but I allude to them here, instead of later, for the sake of convenience). And I am sorry to see that Punnett's *Mimicry in Butterflies* is not mentioned, though possibly Carpenter & Ford's *Mimicry* suitably takes its place. The name of Ford reminds me that neither his *Butterflies* nor his *Moths* is in the bibliography. These are, in a sense, popular books, but apart from the specialized competence of the author, they are valuable for the light they throw upon the problems of genetic permutations in the British Lepidoptera.

Selection, based on a much more extensive knowledge than I possess of what is available elsewhere, must be mainly responsible for this, and a line had to be drawn at some point. But it seems to me that, as a half-page at the end of the Lepidoptera bibliography happens to be blank, more latitude might have been allowed.

As regards Coleoptera, I cannot but deplore the absence of Joy's *A Practical Handbook of British Beetles*, 2 vols. Designed on a somewhat different system from the one employed in Fowler & Donisthorpe's *British Coleoptera*, it may perhaps be considered complementary to that work, and it is interesting to learn that it has, apparently, proved itself of signal service to the employees of the Forestry Commission. To revert for a moment to Fowler, he alone is given credit for this great monograph, although Donisthorpe had much to do with the sixth, and final, volume, and his name is printed with that of Fowler on the title-page and the binding. Moreover, it was Donisthorpe who wrote *An Annotated List of the Additions to the British Coleopterous Fauna* which, issued in book form in 1931, is, though unmentioned in the bibliography, a decidedly useful addendum to the larger undertaking.

Handbooks on Diptera, planned to enlighten the intelligent enquirer rather than the informed expert, are scarce, and I would have liked to observe a mention of Collyer & Hammond's *Flies of the British Isles*. Within its scope it is first-class and the authors maintain a distinguished level. And as Saunders's work on the British Hemiptera-Heteroptera is in the bibliography, why not Edwards's work on the British Hemiptera-Homoptera? And there is no allusion to any of the eight Parts (nine with the Introductory Part), composing Vol. I (all issued to date), of *The Generic Names of British Insects*, which also includes species, sponsored by the Royal Entomological Society of London. These Parts, compiled by men who know their subjects through and through, deal with Lepidoptera (Rhopalocera), Odonata, Neuroptera, Hemiptera-Heteroptera, Hymenoptera Aculeata, and (in Coleoptera) Staphylinidae, Carabidae and Hydradephaga; and though, as in other cases, they doubtless provide information available elsewhere, it is improbable that such information is, at once, so concentrated, so historical and so current. It is a fact that in index form —a different and attenuated thing—the names of genera and species are given in the series next to be described, but the importance of the booklets is not thereby invalidated.

This series, also sponsored by the Royal Entomological Society, is called collectively *Handbooks for the Identification of British Insects*. Twenty-six have appeared so far, most of them since 1952. But of those issued before or in that year (and, in a single case, later) all, save Duffy's *Cerambycidae* (Coleoptera), do, I am glad to say, find a niche in the bibliographies. The list is as follows: Delany's *Thysanura and Diplura* (its 1954 date proves how relative is the '1952' generalization), Hincks's *Dermaptera and Orthoptera,* Kimmins's *Plecoptera,* Kimmins's *Ephemeroptera,* Fraser's *Odonata,* two booklets on *Symphyta* (Hymenoptera) by Benson, and two on Diptera, *Introduction and Key to Families* by Oldroyd and *Nematocera* (part) by Coe, Freeman & Mattingly. Of the subsequent booklets produced up to now, all are concerned with Coleoptera, Hymenoptera and Diptera, with the exception of one of the most recent, Smit's *Siphonaptera,* which, to mention it here for convenience sake again, is, with its Supplement by the same author, 'The Recorded Distribution and Hosts of Siphonaptera in Britain' (*Entomologist's Gazette,* January, 1957, and now obtainable separately), evidently quite up to the admired standard of the other booklets, three of which, *Dermaptera and Orthoptera, Odonata,* and *Diptera: Introduction and Key to Families* have gone into second, revised editions. When all the Orders have been surveyed, this series will assuredly rank as one of the most satisfactory ever designed to aid students of the British Insect fauna.

Of outstanding works published in English since 1952, I would draw attention to Balfour-Browne's *British Water Beetles,* Vol. III; Hopkins & Rothschild's *An Illustrated Catalogue of the Rothschild Collection of Fleas,* Vol. II (the entry in the bibliography does not mark the first volume as 'Vol. I', which is very misleading, as the work is not even yet complete); Barnes's *Gall Midges of Economic Importance,* Vol. VII; Oldroyd's *The Horseflies of the Ethiopian Region,* Vols. II & III; Hincks's *A Systematic Monograph of the Dermaptera of the World,* Vol. I; Clarke's *Catalogue of the Type-Specimens of Microlepidoptera in the British Museum (Natural History) described by Edward Meyrick,* Vols. I-III; Johnson's *Annotated Catalogue of African Grasshoppers*; Fraser's *A Reclassification of the Order Odonata,* to which might be added the articles, now collected in lettered wrappers, of Gardner's *A Key to the Larvae of the British Odonata.*

I have scarcely scratched the surface of the material that, issued usually not later than 1952, might, if my opinion be well based, have found a home in the bibliographies; or, issued since 1952, must be considered for a future edition. Such works have poured and continue to pour from the presses of the world, and even behind the Iron Curtain there is intense activity in the production of natural history publications. But I have, I trust, offered sufficient examples to prove what almost insurmountable difficulties await the compilers of modern bibliographies of Insects: their knowledge must be cyclo-

paedic and their judgment balanced and impartial. And all credit is due to Messrs. Richards & Davies, whose achievement appears the more impressive, the more one appreciates from personal examination the labour implied by steering an enlightened course through the tangled mass of the relevant literature. It is easy for the critic to make suggestions and even, on occasion, to find fault, but the task of choosing the essential from the huge body of contemporary work and of such as has stood the test of time, work covering learned journals and learned books in various languages, was one which, whatever the shortcomings, few scholars could have accomplished so successfully.

I am sorry to have to close on a cavilling note, but it must be admitted that the presentation of the bibliographies leaves much to be desired. There seems to have been little co-ordination between the compilers as to how the facts were to be set forth, with the result that inconsistencies abound. Take, for instance, the Ray Society: seven of its publications are included in these bibliographies: in three cases the Society's name is omitted; in one case it is given correctly as 'Ray Soc.'; in two cases a full stop is placed after 'Ray' ('Ray. Soc.'), as if it were a shortening of a longer word; and in one case it is spelt 'Roy. Soc.', which suggests that the Royal Society were the publishers. (Another actual mistake is to say that Tutt's *A Natural History of the British Lepidoptera* is in eight volumes: it is in nine.)

Some books are described in ample detail, others of at least equal worth are allotted merely dates and titles. Such contrasts immediately catch the eye, but for a brevity which is particularly unfortunate I would mention that monumental work edited by Seitz, *The Macrolepidoptera of the World*, the dates and main account of which are condensed to '1906 *et seq*'. But 'Seitz' deserves better than this: of the English edition no fewer than twelve volumes—it would have been thirteen were I referring to the German edition—of which three are substantial Supplements to the Palaearctic series, are complete, while eight others are in various stages of incompleteness, two being almost ready. And surely the group of volumes by Pierce, Beirne & Metcalfe merited a more expansive main entry than 'The Genitalia of the British Noctuidae, etc. 7 vols.'. For their range includes the Butterflies and larger Moths, the Noctuids, the Geometers, the Tineids, the Tortrices, and the Pyrales, Deltoids and Plumes. All these volumes depict, with explanatory notes, the clasping organs of both male and female, except the original volume on the Noctuids, which depicts only the male: thirty-three years later a companion volume on the female was added. War shortages caused the edition of the last to be limited to one hundred copies, and a reprint of it, with addenda and corrigenda by Tams, has since been issued. This set of books is of fundamental value to the scientific investigator, and a more detailed summary of them would have been welcome.

But there it is. Lack of system, leading at times to a sense of disproportion, is evident throughout these bibliographies. For example, an unfinished work may be so described, but this is not invariably done. Naturally, anybody is liable to slip up, but exactitude is of the very essence of bibliography and procedure should be founded upon accepted usage. And why, therefore, should the Dermaptera section of the already-mentioned booklet on Dermaptera and Orthoptera (R.E.S.) be relegated to a footnote at the end of the Dermaptera bibliography, instead of taking its rightful place? After all, in the similar booklet on Thysanura and Diplura each subject is separately listed in the proper bibliography.

The account of a work in, say, two volumes may be elaborate, both volumes being given their full quota of pages, plates and text illustrations, or, in reverse, the number of volumes (though more than one is suggested from a double date) and what they contain may be ignored. Also, the account may refer to them as '2 vols.', or as 'I and II', or as '1 and 2', or simply as '2'.

In brief, no water-tight method has been evolved, and the usefulness of these fine bibliographies is adversely affected by their haphazard lay-out. The compilers of bibliographies should bear in mind that the synchronization of small points inspires confidence in those who consult them, for such bibliographies would not, as in the present case, appear to lay undue emphases, while their ordered uniformity would tend to strengthen belief that a like care had been expended on the text. Admittedly, minute errors and careless divergences are trivial in themselves, but though actual errors seem to be few, divergences are many, and these are not necessarily trivial in their cumulative influence.

To sum up, the wording of bibliographical data should follow definite rules, and the manner of conveying information ought to be as consistent as the facts presented are accurate.

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100 YEARS AGO

From a letter to the Editor of *The Entomologist's Weekly Intelligencer,* by J. Birks, York, 30th August, published Saturday, 10th September, 1859.

'I recently witnessed a larva of S. Ocellatus perform a curious feat, analogous to that of licking itself. I was watching a brood, and noticed something peculiar about the movements of one of them; presently it began the process of licking, which it performed by means of a brush-like apparatus (shall I call it a tongue?) beneath the jaws, which it passed over every accessible part of its body, pushing forward its head, exactly after the manner of a cat, leaving its skin glossy with moisture, which soon disappeared.'

BOOK REVIEW

An Introduction to the Behaviour of Invertebrates, by J. D. Carthy (1958). pp. xiii, 380, 4 photographic plates, 148 text figs. George Allen & Unwin Ltd., London. Price, 45s.

The author of this book approaches the subject of animal behaviour from a restricted point of view, that of their sensory physiology and responses to physical and chemical stimuli. The arrangement of the chapters is, in fact, by reference to a classified list of such stimuli, except for a first chapter on sense organs and a final short one on 'whole patterns of behaviour'. Accordingly most of the text is devoted to description of experimental evidence, and there is little reference to observation of entirely uncontrolled behaviour under natural conditions.

Within these limitations the book is admirable: it is obviously comprehensive (the bibliography comprises 591 titles), methodically presented and written in clear and simple language. The text figures, mainly diagrams, are of uniformly high standard, but the four photographic plates could have been omitted without affecting the quality of the book in any way.

In his preface the author admits that greater attention has been paid to insects than to other invertebrates: to entomologists that is, of course, a recommendation. The book is replete with little known data concerning insects, of which one example is presented to readers of this journal: The auditory organs of nocturnal moths (p. 228) have nothing to do with courtship behaviour, but their range of sensibility is very like the frequency range of sounds produced by bats when they are locating objects by their well-known echo-sounding method. In addition the reaction of moths to artificially produced sounds of this kind is one of escape, either by flight or by dropping to the ground and feigning death. The attractive suggestion is made that these organs have been evolved with particular reference to predation by bats.

To experimental workers in the field of animal behaviour this is an indispensable book of reference. It will also be of great value to field observers who desire to interpret their observations precisely in terms of the physiology of the animals they are studying.

M.W.F.T.

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100 YEARS AGO

From *The Entomologist's Weekly Intelligencer,* No. 158, 8th October, 1959, p. 11.

'To Correspondents'

'A.S.P. The Entomological Society of London would not accept insects in exchange for its "Transactions".'

A NEW SPECIES OF PHYTOMYZA (DIPT., AGROMYZIDAE) NEAR *PHYTOMYZA AFFINIS* FALLÉN

By G. C. D. GRIFFITHS, F.R.E.S.

For the past five years the existence has been known of a species of Phytomyza which occurs only in the months of October and November, mining the leaves of *Centaurea nigra* L. It was first found by the author near Brookman's Park, Herts., in 1953, and in the following years a fair series has been bred by Mr. K. A. Spencer and the author from Scratch Wood, Middx. Professor E. M. Hering of Berlin has stated in correspondence that he has seen the same species in Germany feeding on *Onopordum,* and he has included the species in his Keys to the European Leaf-miners (Hering 1957) under the keys for *Centaurea* and *Onopordum.*

The species is biologically easily recognisable by the full-depth upper parenchymal mine, similar to that of *Phytomyza atricornis* Meigen. The puparia, which remain in the leaf, are usually metallic black and very characteristic, being readily distinguished from those of *P. atricornis* by the protruding horns on which the hind spiracles are situated. The true *P. affinis* Fall., feeds in the inner layer of cells of the palisade parenchyma, hence its mine has a characteristic pale green appearance. And apart from these differences, the new species is found only in October and early November. There appears to be a partial second generation, as some flies from puparia collected in October will emerge during November.

The occurrence of a species whose larvae feed only in October is not unprecedented. *Phytagromyza heringi* Hendel on *Fraxinus* is an obvious example. The problem which is unsolved is how these species pass the summer. For the adults from the October generation duly emerge in spring or early summer, at any rate under laboratory conditions.

Morphologically the distinction of the new species from *P. affinis* Fall., is critical, and I have come to the conclusion that they cannot be separated in the adult stage. It is clear that the species have only recently become differentiated, and that the process is not yet complete. Future authors might well prefer to treat such species which have not yet become distinct in the adult stage as biological subspecies, as Professor Hering has already done with *Phytomyza ranunculi stolonigena* Hering and *P. ranunculi caulinaris* Hg. (Hering 1949).

The full description of *P. affinis* Fall. and the new species now follows.

Phytomyza affinis Fallén

Head:

Frons narrowing forwards: width at level of front ocellus 2-2.4 times the width of an eye: width at the level of the base of the antennae 1.5-1.8 times the width of an eye: total length of frons to the base of the antennae 0.3-0.4 mm. Lunule strongly concave, somewhat narrower than a semicircle: ratio of height of lunule to the distance from the tip of the lunule to the front ocellus 1.5-2.2. The ocelli form a triangle whose base is slightly longer than its sides (ratio of base to sides 1.13-1.43): the front angle makes 75°-90°. Ratio of the base of the ocellar triangle to the width of the frons 3.75-4.25. Two upper fronto-orbitals (ors), the second almost as long as the first, directed backwards. Two lower fronto-orbitals (ori), directed inwards, the first long, the second very short, less than 1/3 of length of first. 2nd ori nearer 1st ori than is the 2nd ors. Distance between 1st ori and 2nd ors about 2/3 of that between 2nd ors and 1st ors: distance between inner vertical bristle (vti) and 1st ors much greater. 2nd ors clearly before the middle of the frons (ratio of 2nd ors to vti over 2nd ors to base of antennae 1.4-1.6). Orbital setulae 1-rowed, directed forwards, 4-9 in number, reaching from 1st ors to antennal base. Ocellar bristle (oc) reaching almost to 1st ori. Post-verticals (pvt) long and diverging, crossing the long convergent vti. Outer verticals (vte) about twice as long as 1st ors, divergent. Cheeks narrow, about half the width of the first antennal segment in front view. Cheeks and orbits narrowly visible above the eye in profile. Jowls 2/5-½ of the height of the eye. Face-line straight or slightly concave: mouth-margin straight to moderately convex, a little protruding in profile. Eyes oval, with short scattered pubescence (not longer than the width of a facet). Antennae moderate-sized, separated basally by less than width of 1st segment: 3rd segment rounded, with coarse pubescence, hairs on fore-margin clearly drooping and as long as the width of the arista. 1 vibrissa, 2-4 peristomal bristles.

Thorax:

3+1 strong dorsocentrals (dc), the 4th before the prescutal suture (prs). Inner post-alar (i.pa) about ½ the length of outer post-alar (e.pa). Acrostichals (acr) 2-rowed, 4-7 pairs, reaching back to the 2nd dc or to between the 2nd and 1st dc. 1-2 intra-alars (ia) before and after the suture. Mesopleuron with 0-3 bristles.

Abdomen:

♀. Basal cone of ovipositor longer than 6th tergite, whitish pubescent with small bristles in basal half, end half shining. 6th tergite a little longer than 5th.

♂ *genitalia:*

(cp. figs. 1, 1a.) Hypandrium small, less than half as long as the aedeagal apodeme. Hypandrial apodeme vestigial. Phallus bilaterally symmetrical: distal section with only one pair of chitinous rods, but sometimes with vestigial traces of a second pair arising from between

the first pair. (This second pair is strongly developed in the related *Phytomyza cecidonomia* Hering). Postgonite smooth, bilobed.

Wing:

2nd costal segment $2\frac{1}{4}$-$2\frac{3}{4}$ times as long as the 4th. $r_1 + {}_5$ straight, diverging from $m_1 + {}_2$.

Size:

Body and wing about 2 mm.

Colour:

Frons and orbits yellowish white. Ocellar triangle shining black, but yellow rim behind it. Occiput behind uniformly dull black. Vte on black ground, but not vti; black continuing about 1/3 of the way down the side of the head. Lunule yellow, slightly darkened at base of antennae. Face yellow on margins and middle, darkened in the hollows. Cheeks and jowls yellow. Palpi black, prelabrum dark brown. Antennae with 1st segment yellow, 2nd black but paler on fore-margin, 3rd black. Thorax and scutellum pruinose grey, apart from the following: dorsal rim of mesopleuron yellow; wing-base and halteres yellow. Squamae yellow with dark fringe. Abdomen dark-brown, shining, with narrow yellow hind-margins to the segments (especially conspicuous on the 6th segment of the female). Ovipositor shining black, pruinose in basal half. Coxae and trochanters black, but the latter sometimes yellow tipped. Tips of femora and bases of tibiae bright yellow: traces of yellow at tips of tarsal segments: legs otherwise dark-brown to black.

Larva:

The larva is fully described in de Meijère (1926). Note especially the following: 'Vorderstigmen . . . mit ca. 18 Knospen. Hinterstigmen von demselben Bau, mit fast gleicher Anzahl von gleichfalls sitzenden Knospen, auf kurzen konischen Trägern'. Fig. 2 shows how this latter character appears in the puparium. The horns are much smaller than in *P. autumnalis* sp. nov. The puparia are normallv transparent white in colour. Darker puparia are normally parasitized.

Biology:

The larva feeds only on the inner layer of cells in the leaf (usually only on the upperside), giving the mine a characteristic pale green appearance. The puparia remain in the leaf in a pupal blister as with *P. atricornis* Meigen. The mine is typically long and thin, not usually twisting back on itself and often fairly straight. Frass-particles separated in rows at the sides of the mine channel. The first generation appears in mid-May in Britain: thence there are successive generations until September. Food-plants: *Carduus* spp., *Cirsium* spp., *Centaurea* spp., *Onopordum acanthium* L., *Serratula tinctoria* L.

P. autumnalis sp. nov.

The adult cannot be distinguished from that of *P. affinis* Fallén. The genitalia of the type are figured (Figs. 1, 1a). They agree with those of *P. affinis*.

Larva:

The larva is described by Hering (1957). Note especially the following (I translate): 'Front spiracle club-shaped, 1-horned, with about 23 irregularly placed bulbs. Hind spiracles similarly built to the front, but only with 18-20 bulbs, which likewise are conspicuously irregularly placed'. After examination of some 15 puparia I am of the opinion that the number of bulbs on the hind spiracles as well as the front is consistently larger than in *P. affinis* Fall., in contradiction to Professor Hering whose description is based on a single larval preparation. I calculate 20-25 bulbs on the hind spiracles. The arrangement of the bulbs too is far less regular (Fig. 4), and the horns on which the spiracles lie are much larger, protruding beyond the abdomen (Fig. 3), often separated by a furrow (Fig. 4). The puparia are usually metallic black, only rarely with yellow pigment, and then opaque not transparent as is usually the case with *P. affinis*.

Biology:

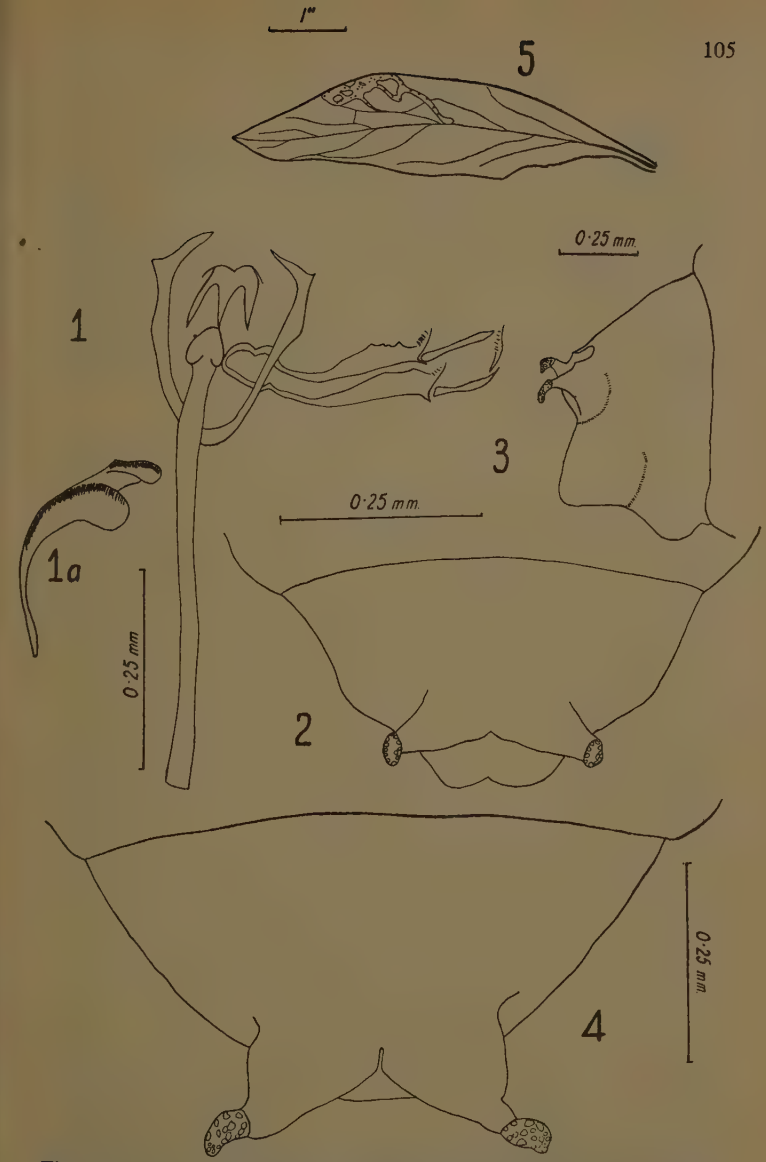
Larva forming a full-depth mine usually confined to the upperside of the leaf. The mine is basically linear, but very irregular, usually doubling back on itself (Fig. 5). In the final stages the frass-particles are more frequent than in *P. atricornis*. Pupal blister formed. Larvae first appear in first week of October. Partial second generation in November. Food-plants *Centaurea nigra* L., *Onopordum acanthium* L.

Type ♂. Scratch Wood, Middx., 13.10.1954 (pupal stage). Emerged 23.10.1954. In the author's collection. Host: *Centaurea nigra* L.

Paratypes. Brookman's Park, Herts., 4.10.1953 (larva). Emerged 18.4.1954. Scratch Wood Oct.-Nov., 1956 (pupae). Emerged Nov., 1956, and Jan.-Feb., 1957 (9 specimens). All bred from *Centaurea nigra* L.

The emendation to Hendel's (1931-6) key has already been published (Griffiths 1956), where *P. autumnalis* sp. nov. is included as 'sp. (undescribed)'. *P. autumnalis* sp. nov. has also been included in Hering's Keys to the European Leaf-miners (1957).

Note. DeMeijère (1926) when giving his records of *P. affinis* states the following. 'Blattgangminen an *Cirsium arvense*: Amsterdam, verpuppt October, im Zimmer 18 Oct. Im. 7-13 Januar des Folgenden Jahres. Puparium glänzend schwarz.' Mr. K. A. Spencer has also bred specimens from *Cirsium* from puparia found in October. Data as follows: *Cirsium palustris* (L.) Scop. Scratch Wood, 21.10.56. Im. 2.11 (2 specimens). *Cirsium arvense* (L.) Scop. Betchworth, Surrey, 4.11.56. Im. 8.2.57. These puparia from *Cirsium* have the characters of *P. autumnalis* sp. nov., but the mines appeared interparenchymal. The status of these specimens remains to be clarified, as to whether they are identical with *P. autumnalis* sp. nov. or are another incipient species.



Figs. 1-5.—1, Male genitalia of *Phytomyza autumnalis* sp. nov.; 1a, Postgonite of same; 2, Posterior spiracles of puparium of *P. affinis* Fallén (dorsal view); 3, Posterior spiracles of puparium of *P. autumnalis* sp. nov. (lateral view); 4, Posterior spiracles of puparium of *P. autumnalis* sp. nov. (dorsal view); 5, Mine of *P. autumnalis* sp. nov. in *Centaurea nigra* L.

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100 YEARS AGO

It is interesting to look back to *The Entomologist's Annual* for 1859 and list the new entomological publications noted or advertised therein.

The Editor (H. T. Stainton) under the heading 'New Works on Entomology' drily remarks 'The number of Entomological publications during the past season has not been oppressively great'.

Catalogue of British Coleoptera, by G. R. Waterhouse.

A Catalogue of the Lepidoptera of Northumberland and Durham, by George Wailes.

The Third Volume of the Natural History of the Tineina, by H. T. Stainton.

Linnaea Entomologica Vol. XI (of this volume it is noted 'Unfortunately it contains no monograph of any genus of Tineina').

The Entomologist's Weekly Intelligencer is advertised—'every Saturday, price One Penny'.

There are two announcements of forthcoming publications.

'On the 1st of January, 1859, will be published, Price Threepence, *No.* 24 *of a Manual of British Butterflies and Moths*'.

(We wonder if any copy of this work in original parts is extant?)

'In the Press'
'The British Tortrices'
'by S. J. Wilkinson'

100 YEARS AGO

In *The Entomologist's Weekly Intelligencer* for Saturday, 1st October, 1859, Arthur Hensman, of Spring Hall, Northampton, notes that 'Ten specimens of the migratory locust (Gryllus migratorius) have been taken in this neighbourhood during the last few weeks'.

(It is interesting to note that the Editor, on 17th September, 1859, said 'The concurrence of three such excessively hot summers in direct succession must be expected to produce a considerable development of more southern forms'.)

THE ISLES OF SCILLY IN 1958

By ROBIN M. MERE

These notes should be read in conjunction with 'Some Preliminary Observations on the Lepidoptera of the Isles of Scilly, with particular reference to Tresco', by Austin Richardson and Robin M. Mere, *Ent. Gaz.* (1958), **9**: 115.

E. C. Pelham-Clinton and the writer spent from the 6th to 16th August, 1958, on Tresco, and made visits to St. Mary's and Bryher. The weather was cool and wet, only the 15th and 16th being fine, and collecting was much reduced by wind and rain. None the less, we found nearly twenty species new to the Scillies, a few of them at mercury vapour light and the majority by work during the daytime.

This is surprising. August is the most popular month for visitors, including visiting entomologists, and we had expected that previous visitors, such as Adkin and Clutterbuck, would have recorded all that was to be found during the daytime in August, especially the Tortricina on St. Mary's. The fact that we found a number of Tortricina on St. Mary's by day new to the Isles of Scilly records suggests that many of these newly recorded species have established themselves in the Scillies during the last twenty or thirty years. An example is *Lozopera franciliana* F., which was locally common on St. Mary's, easily disturbed between 3 p.m. and 4 p.m. B.S.T., and not inconspicuous. Other examples are *Eucosma nisella* Clerck, seen by day both on St. Mary's and Tresco, *Cacoecia podana* Scop., of which larvae and pupae were found in spinnings of *Euonymus japonica* on St. Mary's, and *Evetria purdeyi* Durr., which was flushed out of a pine tree on St. Mary's and taken later on Tresco at mercury vapour light.

Mr. H. C. Huggins spent from 14th June to 5th July, 1958, on Tresco. His visit is the subject of two instructive and interesting articles which appeared in the *Entomologist* (1958) **91**: 251 and (1959) **92**: 14. He has kindly consented to the incorporation of some of his records in these notes.

Apart from a few migrants, insects were on the whole scarce in 1958. In spite of this over thirty species were noted that were previously unrecorded, thirteen of them by Mr. Huggins. Eighteen species were seen that were recorded in Blair's list (*Entomologist* (1925) **58**: 3 and 38), but their continued existence in the Isles of Scilly had not recently been verified.

We were more than ever struck by the absence of several common insects that one would expect to find in the Isles of Scilly. Why should *Crambus tristellus* F. be absent? It is common in apparently similar coastal localities at Land's End, no more than thirty miles away, and in fact generally common on the mainland. The same may be said about *Coenonympha pamphilus* L. (Small Heath). Both

are grass feeders. In the case of another strange absentee, *Leucania lythargyria* Esp. (Clay), we thought excitedly one morning that we had one in a mercury vapour trap, but of course it was *L. unipuncta* Haw. (White Speck).

We saw a number of interesting insects. One *Chilodes maritima* Tausch. (Silky Wainscot) was seen in early August, an exceptionally late date for a fresh specimen. Three *Nonagria sparganii* Esp. (Webb's Wainscot) were found in the mercury vapour trap in the Tresco Abbey gardens, and we were puzzled to know where they had bred, for the nearest food-plant known to us was a considerable distance away. We counted in all six *L. unipuncta* Haw. (White Speck), all fresh, and evidence that this rare insect is still well established and breeding in the Scillies. *Laphygma exigua* Hübn. (Small Mottled Willow) was fairly common, and it seems likely that it is resident at the present time. We also saw *Nycterosea obstipata* F. (Gem), and this too may well be established as a resident. *Lithosia quadra* L. (Four-spotted Footman) was abundant, and doubtless a resident.

We saw several *Colias croceus* Fourc. (Clouded Yellow)), including one var. *helice* on St. Mary's, and on Tresco three *Plusia ni* Hübn. (Ni Moth), all in one mercury vapour trap on the same night, one *Herse convolvuli* L. (Convolvulous Hawk), and six *Rhodometra sacraria* L. (Vestal), from which ova were obtained and a number bred. *Vanessa cardui* L. (Painted Lady) was not nearly as common in August as Mr. Huggins found it in June.

We tried hard, without success, to find *Cosymbia puppillaria* Hübn. (Blair's Mocha) in the Abbey Gardens. We dusked, we ran a mercury vapour trap, and we searched by day. In addition we searched *Quercus ilex* both by day and by night for larvae. We found several signs of fresh feeding, but in every case the larva responsible proved to be *Biston betularia* L. (Peppered).

Imagines of *Crocidosema plebeiana* Zell. were quite common near the food-plant *Lavatera arborea*, and we found a number of larvae of *Nothris congressariella* Bruand on *Scrophularia scorodonia*.

The following insects recorded in Blair's 1925 list were verified for the first time in recent years, Mr. Huggins's records being indicated by his initials, H.C.H.

Pieris napi L. (Green-veined White) on St. Mary's
Nymphalis io L. (Peacock) on St. Mary's.
Amathes triangulum Schiff. (Double Square-spot) on Tresco, H.C.H.
Apatele psi L. (Grey Dagger) on Tresco, H.C.H.
Gnophos obscurata Schiff. (Annulet) on St. Mary's.
Salebria fusca Haw. and *S. betulae* Göze on Tresco, H.C.H.
Meliphora grisella F. on Tresco, H.C.H.
Hemimene petiverella L. on Tresco, H.C.H.
Gelechia desertella Doug. on Tresco.
Phthorimaea marmorea Haw. on Tresco.

Borkhausenia fuscescens Haw. on Tresco.
Depressaria umbellana Steph. on Tresco.
Argyresthia goedartella L. on Tresco.
Gracillaria tringipennella Zell., both mines and an imago on Tresco.
G. stigmatella F. on St. Mary's and Tresco, mines being on both Sallow and White Poplar.
Lyonetia clerkella L. on Tresco feeding on apple.
Meessia argentimaculella Staint. on Tresco.

The following are additions to the Scilly list, in all cases on Tresco and recorded by Pelham-Clinton and the author unless otherwise stated, one being an insect taken in 1957 and but recently identified.

Amathes baja Schiff. (Dotted Clay) by H.C.H.
Procus fasciuncula Haw. (Middle-barred Minor) by H.C.H.
Plusia ni Hübn. (Ni moth).
Electrophaes corylata Thunb. (Broken-barred Carpet) by H.C.H.
Hydriomena coerulata F. (May Highflyer) by H.C.H.
Eupithecia venosata F. (Netted Pug) by H.C.H.
Phlyctaenia fuscalis Schiff.
Pyrausta olivalis Schiff. by H.C.H.
Scoparia ambigualis Treits. by H.C.H.
Lozopera francillana F. on St. Mary's. Can this, I wonder, have been incorrectly identified in the past and be the *L. dilucidana* Steph. of Blair's list?
Euxanthis straminea Haw. by H.C.H.
Cacoecia podana Scop. on St. Mary's, larvae and pupae on *Euonymus japonica.*
Peronea caudana F.
Acroclita naevana Hübn.
Evetria purdeyi Durr. on St. Mary's and Tresco.
E. pinivorana Zell. by H.C.H.
Gypsonoma dealbana Fröl.
Eucosma nisella Clerck on Tresco and St. Mary's.
Bactra lanceolana Hübn. by H.C.H. and later by us.
Endothenia oblongana Haw. by H.C.H.
Argyroploce cespitana Hübn. by H.C.H.
Hemimene flavidorsana Knaggs by H.C.H. and later by us.
Laspeyresia woeberiana Schiff.
Gelechia senectella Zell.
Stomopteryx taeniolella Zell.
Swammerdamia pyrella Vill.
Coleophora versurella Zell. in 1957 in bulb fields behind New Inn, Tresco. This is a most interesting record of an insect first introduced to the British list by Mr. J. D. Bradley in *Entomologist* (1959) **92**: 27.
C. flavaginella Zell. among *Atriplex* on seashore.
Ornix guttea Haw., larvae on apple.

Gracillaria syringella F.
G. sulphurella Haw.
Tischeria marginea Haw.
Tinea lapella Hübn.

In addition several examples were taken of a *Phthorimaea,* which appears not to be any of the known British species, and which so far is unidentified. There are also unidentified pupae.

Clearly there is still much more to be done before the list of the lepidoptera of the Isles of Scilly is reasonably complete.

Once again our most grateful thanks are due to Lieutenant-Commander T. M. Dorrien-Smith, R.N., for his kindness and hospitality in permitting us to collect and to work a mercury vapour trap in his magnificent gardens at Tresco Abbey.

I wish also to thank Messrs. E. C. Pelham-Clinton and J. D. Bradley for identifying many of the smaller insects and assistance with these notes.

12th February, 1959.

RECENT LITERATURE

Transactions of the Suffolk Naturalists' Society, 1958 (Vol. X. Part IV). pp. 271-359. Wrappers. Price 7s. 6d.

This flourishing Society has over 650 members. The standard of its publications is high and care has been taken to balance the contents as between Insects, Birds and Plants.

It seems a pity that 'A Review of British Lepidoptera for 1957', by Baron de Worms, is so general in its scope. It would serve the interests of the Society much better to have a more local approach—and the author is certainly qualified to write on a subject of greater interest to the Suffolk lepidopterist.

Two short papers by Alisdair Aston—'A New Suffolk Moth, *Pammene aurantiaria,* Stdgr.' and 'Other Micros New to Suffolk' are excellent—but a third by the same author—'Midwinter Insects', although interesting, is a half-page filler; Suffolk is introduced only incidentally.

'Phoridae (Diptera) New to the Suffolk List', by L. Parmenter, is a fine example of first-class matter properly suited to the medium of publication.

Local and County Societies still have a great rôle to play, but there is a tendency for them to publish matter of a general nature; this tendency should be resisted for the sake of their own health.

E.W.C.

ANT VECTORS IN THE LIFE-CYCLE OF THE LESSER LIVER FLUKE, *DICROCOELIUM DENDRITICUM* (RUDOLPHI 1819) (TREMATODA: DICROCOELIIDAE)

By A. N. BRANGHAM

The somewhat meagre information about the rôle of ants in medical and veterinary science has been reviewed briefly by O'Rourke (1956), who points out their importance as transmitters of pathogenic organisms which are injurious to man and animal. He also considers the cutaneous or systematic reactions to the bites and stings of a number of ant species, while their indirect influence may be shown in connection with the transmission of plant diseases. The culture of aphids may affect adversely the production of food and may be responsible for hunger and deficiency diseases. O'Rourke considers that 'the ubiquity of the *Formicidae* and the predatory nature of many species gives them an important rôle in reducing the numbers of many arthropods of veterinary and medical importance'.

Of the many insects involved as intermediate hosts in the life-cycles of true parasitic organisms (i.e. those that are obligatorily saprozoic and do not, for the most part, kill their hosts or, if they do, only after a considerable lapse of time, and are then distinguished by the name of parasitoids) ants seem to play a comparatively insignificant part. Their importance in veterinary husbandry is inconsiderable but of great interest biologically. O'Rourke's paper recognizes these facts, so that the section which deals with ants as cyclical vectors of disease does not go beyond a cursory review of current knowledge, some of which is discussed at greater length in this present paper.

Borchert (1954) gives brief information about ants as vectors amongst the cosmopolitan helminth genus *Raillietina* (Cyclophyllidea: Davaineidae), and the species requiring ants as intermediate hosts are given below. The list follows Borchert, but additions have been made from other sources of reference for the sake of completeness:

Raillietina tetragona Molin 1858

Final Hosts: Hens, pheasants, turkeys, guinea-fowls.

Intermediate Hosts: Houseflies and species of ants which are not named by Borchert, but Horsfall (1938) has demonstrated that *Tetramorium caespitum* is an intermediate host; small snails belonging to the genus *Helix*.

Raillietina echinobothrida Mégnin 1881

Final Hosts: Hens, pigeons, pheasants, peacocks, turkeys.

Intermediate Hosts: The ants *Tetramorium caespitum* in Maryland (Jones & Horsfall 1935, 1936), *Tetramorium semilaeve* in the

Marseilles region (Joyeux & Baer 1937), and *Pheidole vinelandica* in the United States (Horsfall 1938); snails of the genus *Helix* are also involved.

Raillietina friedbergeri von Linstow 1877.

Final Hosts: Pheasants and turkeys, and, according to Joyeux & Baer (1936) peacocks.

Intermediate Hosts: Probably ants, according to Borchert, and more specifically *Formica rufa* (Joyeux & Baer 1936).

In all three cases quoted above the infection area in the final host is the small intestine.

O'Rourke (*op. cit.*) states that the intermediate hosts of the majority of *Raillietina* species are still unknown, and he thinks it likely that the *Formicidae* will supply many of them.

In addition to referring to the list of *Raillietina* species given by Borchert, O'Rourke says that another species, *Raillietina* (*Paroniella*) *urogalli* Modeer, a parasite of the red grouse *Lagopus scoticus scoticus* Latham may be carried by *Myrmica rubra* L., and *Myrmica scabrinodis* Nyl., in the body-cavities of these ants which are found, in infected condition, on grouse moors. This investigation was carried out by Muir (1954). Cysts have been found in males, females and workers of both species, and an infestation rate of 8 per cent. was determined after dissection. Infected ants may be recognized by the unnaturally dark chocolate colour of the entire cuticle. Most ants contained only a single parasite, but as many as fifty have been found in a female of *Myrmica rubra*.

Apart from the genus *Raillietina*, amongst certain species of which ants appear to play a decisive part as intermediate hosts, there is only the lesser liver fluke, *Dicrocoelium dendriticum* [1] for whose life-cycle ants may be instrumental.

The primary interest in the lesser liver fluke is biological rather than economic, since the damage caused by it to its major final host, the sheep, is far less than that done by the better known liver fluke,

[1] According to Leiper (personal communication 1958) *Dicrocoelium dendriticum* Rudolphi 1819, has been accepted almost universally by helminthologists, but it may be noted that Dollfus (1956) in a French entomological journal, uses the name *Dicrocoelium lanceolatum* Rudolphi 1803, and, in a paper in the same journal (Brangham 1958) discussing the wider myrmecological significance of the helminth's life-cycle, I followed Dollfus in using the name *D. lanceolatum*. Leiper points out that, in 1896, Stiles and Hassell indicated that *D. lanceolatum* Rudolphi 1803 was preoccupied by Schrank in 1790 for a trematode species in cyprinid fishes, and submitted *D. lanceatum* nom. nov. In 1910 Odhuer examined Rudolphi's original specimens in the Natural History Museum in Berlin and wrote '*Dicrocoelium dendriticum* (Rud. 1819) der richtige Name des kleinen Leberegels' with *D. lanceatum* Stiles and Hassell 1896 as a synonym. Borchert (*op. cit.*) uses the name *D. lanceatum* Stiles and Hassell, as does Svadjian (1954). In view of Leiper's comments, it is difficult to see why Dollfus employs the preoccupied name, and *D. dendriticum* 1819 will be used in this paper.

Fasciola hepatica. Nevertheless, Dollfus (personal communication 1957) has said that various pastures in different parts of France have had to be evacuated on account of infestation by this parasite.

A few years ago it was thought that our knowledge of the total life-cycle of the lesser liver fluke was complete, but it is now realized that there were lacunae due to ignorance of the entomological aspects of the parasite's existence, and although recent research has supplied interesting material, we are still not at the point where it can be said beyond all contradiction that ants are obligatory intermediate hosts, and this paper hopes to show that there are still various details pertaining to ant colony organization and ecology which require investigation.

It had for long been assumed that there was only one intermediate host in the life-cycle of *Dicrocoelium dendriticum*, a snail which might be one of a number of species,[2] and Neuhaus (1936) first discovered the process whereby the parasite develops in and passes through the mollusc (*Zebrina detrita* was the species concerned in Neuhaus's experiments). Previously, Vogel (1929) had suspected the existence of a second intermediate host, but this was not demonstrated until 1952, when Krull and Mapes (1952) reported that ants were the second intermediate host in the life-cycle of the lesser liver fluke, a fact which has been established both in the field and also experimentally. This was confirmed in the Soviet Socialist Republic of Armenia by Svadjian (1954), and also in Western Germany in a thorough paper on experimental and observational work by Vogel and Falcão (1954). All these papers having been published in veterinary and parasitological journals, Dollfus (*op. cit.*) and O'Rourke (*op. cit.*) both performed a valuable service by publishing notes in entomological media on the whole subject in order to draw the attention of myrmecologists to the interesting phenomenon. The eminent German myrmecologist Gösswald collaborated in the work of Vogel and Falcão, but I have not come across any independent publication of his own on this subject. In response to Dollfus's paper, I have discussed the theoretical aspects of the discovery of Krull and Mapes in the light of our knowledge of ant-behaviour and ant-parasitism and the possible implications of these in the life-cycle of the fluke. The emphasis in that paper was naturally on the ant species of France and their distribution, as Dollfus seems to suggest that little is known about the helminth's distribution in France. It may be noted that a list of European ants of the genera *Polyergus* and

[2] The following molluscs have been recorded in the relevant literature as first intermediate hosts to *D. dendriticum* in both the Old and New World. They are all terrestial gastropods: *Helicella* (*Candidula*) *candidula, H.* (*C.*) *unifasciata, H. ericetorum, H. striata, H. crenimargo, H. itala, H. derbentina, Zebrina detrita, Z. hohenackeri, Torquilla* (*Abida*) *frumentum, Euomphalia strigella, Theba cermenelea, T. carthusiana, Cionella lubrica, Helix aspersa, Ena obscura, Malacolimax agrestis, M. tenellus,* and *Chondrula tridens.*

Formica that might, theoretically at least, be concerned with the life-cycle of the lesser liver fluke (German: lanzettegel, French: la petite douve du foie) was given in this paper.

LIFE-CYCLE OF *D. DENDRITICUM*

The definitive or final hosts to *D. dendriticum* are ruminants (mostly sheep), pigs, single-toed mammals, carnivores, rodents, and man but seldom. The seat of infestation is the liver or bile ducts.

The fluke becomes mature after its complex life-cycle, in the liver or bile-duct, when it is from 6-10 mm. in length and between 1.5 mm. and 2.5 mm. broad. The cuticula is smooth, without spines. The eggs are laid in the liver of the host and are thick-skinned and dark brown in colour; the size of the eggs is in the region of 38-45μ : 22-30μ. The eggs themselves have considerable powers of resistance, and it has been found that they can withstand temperatures up to 38 deg. C. for more than ten weeks, and even up to 50 deg. C. for 24 hours. At the other extreme, they can resist minus 50 deg. C. for 24 hours. They can remain alive in water for more than 16 months. After four weeks at a temperature of 25 deg. C. they dry out. Eggs deposited with excreta can survive for 20 weeks. This capacity for resistance distinguishes *D. dendriticum* from the better known liver fluke, *Fasciola hepatica*.

The eggs are dropped at random with the faeces of the definitive host and are later ingested with its normal food by the first intermediate host, a snail. The snails most commonly observed in Europe acting in this capacity are *Zebrina detrita, Helicella ericetorum, Helicella candidula,* and *Helicella striata*.

All these snails are lime-loving terrestial molluscs, preferring dry, stony, strongly insolated regions, with sparse plant-growth, the plants themselves being confined to calcareous soils. The snail vectors tend to prefer the uplands to low-lying areas. During prolonged drought the snails burrow into the ground, or when their environmental conditions are unfavourable, they attach themselves to blades of grass or shrubs by means of an exudation of adhesive slime, and in this position they are able to survive long periods with neither food nor water.

When the egg has been ingested by a snail, a miracidium is released from one end of the egg-case out of a spring-lid device into the digestive tract of the mollusc. The miracidium possesses a boring apparatus which it uses to drive quickly into the lymphatic glands of the snail's colon. Here cell-division takes place and the miracidium grows into a sack- or egg-like shape, and at this stage it is called a sporocyst, which encloses between 25 and 100 embryonic spherical forms. These transform into the second stage of the sporocyst in which the shape of the body becomes more tube-like, rounded front and rear, 2.0-3.5 mm. : 0.2-0.4 mm. in size, growing rapidly to

the extent that the glandular tissue of the snail is displaced. There is further cell-division and differentiation to give rise to cercariae.

The mature cercariae (of the type *Cercaria vitrina* von Linstow 1887) have elongated bodies, constricted so as to form a distinct tail which may be larger or smaller than the anterior body. There is a cup-shaped oral sucker on the ventral forward part of the body, and there is also an abdominal food sucker roughly in the middle of the body. The size of this part of the cercaria ranges between 360-760μ : 50-165μ, and the tail 200-1000μ. Close to the mouth at the anterior end of the body lies a borer or lancet, 21μ in length, and it is provided with a muscular sheath. The body has eye-spots and contains between 20 and 28 tube-shaped glands which are connected with the anterior sucker by the narrow ducts that lie close to the lancet. Almost the entire body (excluding the ciliated portion) is taken up by these glands whose function it is to excrete the envelope during the process of encysting.

Growth at this stage is slow, so that one may find in a fully grown sporocyst all stages of development. Mature cercariae leave the sporocyst through the throat-shaped vagina of the mollusc and pass into the respiratory cavity. A few of them also enter the intestinal tract and are expelled with the snail's excreta, and these cercariae soon die off through dehydration. In the respiratory cavity the cercariae begin to encyst while still retaining their lancet and tail. 200-400 cercariae encyst themselves communally by means of the slime secretion of the large glands to which reference has already been made. The result is a large collective cyst. On account of this glandular activity the glands themselves are voided completely so as to provide the slime envelopes. The envelopes are ejected by the snail out of its respiratory cavity. The mollusc's rhythmic breathing movements gradually press out the gelatinous mass of encysted cercariae, and this repeated movement, which takes place between 5 and 15 times, forces the envelopes into grape-like masses which, on account of their sticky nature adhere to the grasses surrounding the snail. According to Vogel and Falcão this expulsion process takes place only under suitable conditions of moist nights, and in addition they found that the method of giving optimum expulsion from the snail in laboratory work was to create artificially a sharp drop in temperature of between 5 deg. C. and 15 deg. C. This was achieved by placing the snails in a refrigerator set at between 8-9 deg. C. overnight. It cannot be taken for granted, however, that these conditions represent the equivalent to natural ones, since the method of these investigators was taken from one employed by Krull and Mapes in North America and, moveover, the snails had been collected in early autumn. The grape-like conglomerations, before finally becoming detached from the snail, are further enveloped by a second, thicker layer of slime which is secreted from the rim of the snail's mantle; these secretions create and protect the shell itself.

In this way a gelatinous ball comes into being and this may harbour as many as 6,000 cercariae. The cercariae use their prehensile tails to enable them to adhere in groups within the mucous envelope. As the snail creeps forward on blades of grass, plants or other objects, the mucous ball is severed from its first intermediate host.

The rôle of the snail at this point in the development of the parasite is important insofar as meteorological conditions may affect adversely the chances of survival of the encysted cercariae. These are sensitive to the degree of moisture in the atmosphere. If, on the one hand, conditions are too dry, the cercariae are in danger of dying from dehydration, while, on the other hand, if they are submitted for too long to a great deal of moisture, fungi appear on the envelope of the cercariae and destroy them. Thus the rôle of the snail is to some degree a protector against excessively adverse climatic conditions. The shell itself acts as a shield against too much heat and dryness since the snail will seek shelter for itself under such circumstances, and will only move on in moister conditions. Borchert (*op. cit.*) points out, however, that the degree of protection afforded by the snail is limited. At 18 deg.-21 deg. C. the cercariae die quickly. Consequently, it is imperative for the cercariae to reach suitable conditions for survival and further development as rapidly as possible after becoming detached from the first intermediate host. It will be seen that the cercariae are as vulnerable to climatic extremes as the eggs are impervious to them.

The next stage in the complex evolution of *D. dendriticum* is at present open to debate, as had been hinted earlier. One school of thought has it that a second intermediate host in the form of ants is essential to the helminth's survival, and the laboratory experiments of Vogel and Falcão, as well as the earlier ones of Krull and Mapes, would indicate that the cercariae may not be able to evolve to the next stage without the assistance of ants. In these experiments efforts to pass the cercariae straight from snail to sheep (or other definitive host) failed to bring to maturity the final stages of the lesser liver fluke, whereas by using certain species of ant the full cycle could be demonstrated frequently by experiment, as well as be observed in nature. On the other hand, Prudhoe (personal communication 1957) has said that ants may not be obligatory hosts since, as far as the British records show, infection of a sheep has been known to derive directly from cercariae in 'slime-baths' deposited by infested snails. This view is held by Cameron (1956), who points out that, as in other helminth infections, the ant may not be an essential host, as the cercariae with tails still attached (i.e. not yet encysted metacercariae as in the ant) have been found in the bile-duct of the definitive host. Leiper (personal communication 1958) appears also to support this argument. Vogel and Falcão, on the other hand, consider that their experimental work shows sufficiently convincingly that an ant vector as obligatory second intermediate host has been reasonably

demonstrated, and Dollfus (personal communication 1957) is emphatic in his belief that direct infestation without an ant vector is impossible.

Certainly the evidence in favour of a single intermediate host (the snail) seems to be based partly on a meagre British record, partly on analogy with the known behaviour of other helminth parasites, and perhaps chiefly on the experiments of Neuhaus (1936), who succeeded, apparently, in feeding encysted cercariae direct to sheep; the cercariae were later found to have developed into encysted metacercariae, but Vogel and Falcão throw doubt upon the validity of the experimental safeguards employed by Neuhaus.

It is clear that further experiment and observation on a considerable scale are called for, but the entomologist can assist the researches into the life-cycle of *D. dendriticum* by a thorough examination of pasture areas of known infection.

Where ants are, in fact, known to be the second intermediate hosts to *D. dendriticum*, the worker ants engaged in foraging at varying distances from their nests, find the encysted cercariae suspended on plants and carry the mass back to the nest, where it will be licked and eaten by other workers of the colony. Under circumstances in which there is ample food easily available to the foragers for the colony, it is quite possible that the gelatinous mass may only be licked by individual foragers and not removed bodily to the nest. Normally, when food is brought back to the nest by the foraging ants, it is shared out amongst the first comers, who will chew food that is solid, pass it into the crop, and regurgitate it in droplet form to other ants within the nest when accosted. Thus the food which has been brought in from outside can be passed indirectly to all members of a colony within a few hours, and this will include the queen, larvae, immature alated males and females should they still be in the nest awaiting the marriage flight, to say nothing of the rich variety of commensals so many species of ant have as permanent guests in their colonies.

The whole question of the degree of spread of regurgitated cercariae, from the foraging workers who have collected the slime-balls to the other members of the colony, is as yet conjectural. Krull and Mapes in the United States, and Vogel and Falcão in Germany, have indicated in their laboratory work that the infestation rate (as shown by metacercariae in the ants' abdomens) is very much higher among those workers which have been engaged actively in foraging for the slime-balls than the infestation rate among the workers in the nest. For example, in two observations, Krull and Mapes determined a 36 per cent. infestation rate among those workers of *F. fusca* that had been foraging in one, and 21 per cent. in another. In the second case Krull and Mapes also counted the percentage of infestation among workers from the dug-up nest, and this proved to be four per cent. The results of some of Vogel and Falcão's experiments led these investigators to conclude that spontaneous infestation in the

field with their *F. fusca* workers was considerably less than infestation brought about through intensive feeling with slime-balls in artificial nests.

The inconclusive evidence in respect of the infestation intensity does not permit us to do more than remark upon the theoretical possibility of infestation of the sexes within the nest. It is of interest at this point to bear in mind the fact that Muir, quoted by O'Rourke (*op. cit.*) has discovered *Raillietina* infestation both in males and females of *M. rubra* and *M. scabrinodis*, as well as workers, to which reference was made earlier in the introductory remarks. This is the only comparable piece of information we have about infestation of the sexes and, of course, no conclusions can be drawn for *D. dendriticum* from the analogy of *Raillietina*.

The winged and immature males and females are fed and tended underground inside the nest until they are permitted to issue forth under the favourable climatic conditions of a warm, still, summer's day, which is not infrequently sultry, for the marriage flight. Intranidal copulation takes place, sometimes in the air, sometimes on the ground, according to the species; the males generally die off after the procreative function, while the fertilized female discards her wings by biting or rubbing them off. She finds a suitable crevice in which to pass the winter, laying her first small batch of eggs in early spring (in the case of *F. fusca*). She survives the winter by living off the degenerated muscle tissue, a process which takes place as a result of the removal of the wings. It will be seen from this brief description of the life-pattern of the female ant that the opportunity to pass cercariae to a final host (supposing always that the female has been successfully infected by regurgitation from her own workers in the nest) is limited to a precise matter of hours. It is conceivable that she will have been swallowed by a sheep while running up and down blades of grass on or close to the nest before she has become airborne. This short period of intense excitement and activity is commonly observable among ants. Or, she could be similarly swallowed after her fall to earth, between the time of biting off her wings (which is a matter of minutes) and finding a suitable cranny in which to install herself for the winter. It would be a great rarity to establish such a fact in nature. The cercariae within a female would presumably die off once an infested female had succeeded in establishing her winter quarters, as the cercariae require no more than 56 days to mature in an ant, and the female herself will in fact have no contact with any other creature until early the following summer when the first small workers emerge and begin the process of foraging and attending to the queen, who thenceforward concentrates solely on egg-laying.

The cercariae pass into the digestive tract of the ants and encyst themselves in the abdominal cavity, and at this stage they are known as encysted metacercariae (Dollfus, Callot and Desportes 1934). These

cysts ripen within the ant, and they are either ejected anally with faecal matter during foraging (or indeed anywhere around the nest) or else the ants themselves are ingested with fodder by the sheep or other definitive host. All the evidence so far is that the ants are in fact swallowed by grazing sheep. In the latter event it may be, therefore, that newly infected worker ants are swallowed whose cercariae will not have matured to the metacercarial stage. That body of opinion which insists that ants are obligatory second intermediate hosts would presumably argue that under such circumstances the cercariae could not mature to the next stage and therefore could never reach full maturity as helminths. The opponents of this view might hold that development to the metacercarial and final stages could take place because they do not see the ant as an essential host.

The size of the ripened cyst is approximately 365μ : 250μ, and has the appearance of an ellipsoid. The enclosing membrane of the cyst is colourless and transparent. During the process of encysting the tails are lost. The maturation period to the ripe metacercarial stage within the ant appears to be between 38 days and 56 days at a temperature of 25 deg. C.

The cysts ingested by the sheep in one of the ways I have already described are dissolved in the intestines and within two hours the cercariae have penetrated the intestinal walls. Then they pass into the portal system where they remain for a few days, and then into the liver between the fifth and eighth day. Cameron (1956) states that the cercariae have an oral spine which is completely buried in the body; its axis is dorso-ventral and not longitudinal as in the tissue-piercing forms, and it appears to be a residual structure of no present use. This agrees well, says Cameron, with the thesis that the forms developing in land snails are of more recent evolution than those in water snails. It is quite probable that *Dicrocoelium* is a comparatively recent parasite of herbivorous animals, because closely related species are parasites of bats, of carnivores, and of birds.

After passing into the liver they may also infect the bile-ducts; at first the fine ducts are invaded, and then the main ducts and the gall-bladder.

The eggs are laid in these areas, and they pass into the intestinal passages to be ejected anally for the first intermediate host, the snail, to ingest them, and they hatch in the digestive tract to give rise to the miracidia and the cycle which has already been described.

ANT VECTORS WITH *D. DENDRITICUM*

Now that the full life-cycle of the helminth parasite has been outlined, it is necessary to take a closer look at the ant species which are, or may be, involved as vectors.

In the original researches of Krull and Mapes the ant vector was stated to have been *Formica fusca* L. both in nature and in the

experimental work. Vogel and Falcão observed and used *Formica* (*Serviformica*) *fusca* L., *F.* (*S.*) *gagates* Latr., and *F.* (*S.*) *rufibarbis* F. var *fusco-rufibarbis* Forel. Certain other species of ant (*Lasius flavus* F. and *Tetramorium caespitum* L.) were used experimentally and without success, and these need not concern us here. The ants were named by Gösswald. Svadjian (*op. cit.*) gives *Formica fusca* L. and *F. rufibarbis* F. as the species used to confirm the initial findings of Krull and Mapes. I have dealt at length (Brangham *op. cit.*) with Gösswald's naming of *F.* (*S.*) *rufibarbis* var *fusco-rufibarbis* as one of the ant vectors used by Vogel and Falcão, so that all that need be said on this point (which involves principles of nomenclatorial niceties with which specialists are constantly concerned but which are rather tedious to the bystander) is that I have followed Yarrow (1955) in his argument that Forel's (1874) conception of varieties is untenable in the light of modern knowledge in genetics, and that the species in question must be either *F. rufibarbis* F. or *F. cunicularia* Latr.

In addition, Vogel has recently written (personal communication 1957) the interesting information that he has observed a weak infestation of the ant *Formica sanguinea* Latr. with metacercariae in the Swabian Jura of Southern Germany. This item will be referred to in greater detail later.

The work of Vogel and Falcão has recognized that there may arise circumstances in nature in which a second species of ant can become involved as additional carrier of the metacercariae of *D. dendriticum*; these ants are the so-called 'slave-making' species of the two closely related genera *Polyergus* and *Formica*. The recognition of this possibility is only implicit by virtue of the fact that they endeavoured experimentally to infect *Polyergus rufescens* Latr., the celebrated 'Amazon ant' of Europe. These writers do not attempt to consider systematically in what manner a second species of ant might be involved as a result of formicine parasitism. Equally, O'Rourke (*op. cit.*) contents himself with remarking that the myrmecologist, who is aware of the possibility of ants acting as intermediate hosts of helminths, will be in a position to contribute to the solution of some parasitological problems.

The fact that parasitism among ants is widespread necessitates a review of this parasitism as it may relate to *D. dendriticum*. The general phenomenon of parasitism in ants is complex because there are many different forms this can take, each form representing a different stage in the social evolution of these insects. For instance, both *Polyergus rufescens* and *Formica sanguinea* have already been mentioned; both are called slavemaking ants, yet their behaviour differs considerably one from the other, as does the evolutionary significance, and, since both of them could be concerned with the trematode parasite, it is necessary to consider each species separately.

P. rufescens is not found in Britain, whereas *F. sanguinea* is found scattered mainly in the southern counties of this country. The former is a permanent social parasite, not only unable to found its colonies unaided, but also unable to feed itself as it has undergone a morphological change in which the powerful mandibles are sharp and pointed, excellent for transfixing an opponent in warfare, but useless for cutting up solid food and shaping particles of earth in nest-building. *P. rufescens* therefore represents the culminating stage in myrmecine dulosis (Wheeler 1923). It must always be supplied with an host species (which may be one of five species of *Formica* ants in Europe) and this host species is replenished from time to time by raids on host species in the vicinity. The pupae are seized and workers put to flight or killed before the invading column returns to its own nest with its booty. The fertilized female of *P. rufescens* can only found a new colony by raiding the nest of an host species, where she seeks out and kills the queen and becomes accepted by the workers in the latter's place. She lays eggs which are reared by the host workers through the larval and pupal stages to maturity, and as these host workers begin to die out (since their means of self-perpetuation have been denied them through the slaying of their queen) raids to bring their number to the optimum begin during the third year of the new *rufescens* colony's existence. The 'slave' species is the exclusive forager; the *rufescens* ants are totally incapable of feeding themselves even in the midst of plenty.

It is therefore logical to suppose that if the foraging host workers bring back the *dendriticum* slime-balls and are able to regurgitate the cercariae in semi-liquid, droplet form, the parasitic species may also be infected. As the *rufescens* workers will not emerge from the nest unless disturbed or they organize a sortie against the *Formica* host species in order to replenish their own stocks, the metacercariae are very likely to be excreted within the nest or very close to it, so that it would be improbable for the cysts to be ingested by sheep with fodder. Sheep would be likely to pick up *rufescens* workers from blades of grass only under the raiding conditions I have mentioned. As *rufescens* workers have the habit of organizing these raids in fairly close military formation, it is possible to conceive the situation in which a number of the ants are ingested simultaneously by a grazing sheep.

Vogel and Falcão endeavoured to infect *P. rufescens,* but the results were entirely negative. The authors say they would have been surprised had an infection of the parasitic species been established, but there is no absolute *a priori* reason for considering the infection of this ant impossible; it would seem to be merely biologically unlikely, but a definite view that *F. rufescens* can or cannot become infected must await information as to whether or not the slime-ball substance can be regurgitated from host to parasite in a form acceptable to the latter. As no precise information is available on this point we

must for the present accept *F. rufescens* as a possible second intermediate host along with its own host species.

The case of *Formica sanguinea* runs superficially parallel to that of the 'Amazon Ant'. It, too, is incapable of forming its own new colonies independently, and must therefore make use of an host species among the *Formica* (seven species of *Formica* have been recorded as hosts). According to Raignier (1952) there are nine different ways in which *F. sanguinea* may found a new colony, but for our purpose the classical method only need be described, and this description is best left to Wheeler (*op. cit.*), who sees in *sanguinea's* parasitism the primitive stage of myrmecine dulosis: 'As soon as the *sanguinea* queen invades a *fusca* colony, she becomes greatly excited and interested in the brood, seizes and collects in a small pile as many pupae as she can snatch up and mounts guard over them. She slays any *fusca* workers that are bold enough to attempt to regain their property and is therefore soon left in undisputed possession of her plunder. Eventually *fusca* workers emerge from the cocoons and at once assume a friendly attitude towards the queen, feed her by regurgitation and behave towards her as if she were their own mother. She begins to lay eggs and the resulting larvae are fed and reared by the black workers, so that when the *sanguinea* emerge a mixed colony is established. These workers show that they have inherited their mother's proclivities by kidnapping the brood of neighbouring *fusca* colonies, but they do this as an army and carry the *fusca* brood to their nest.' An important biological distinction between *P. rufescens* and *F. sanguinea* is that the latter has not undergone the morphological degeneration of the mandibles, so that, although this species (along with many others in the ant world) cannot found its new colonies unaided, it is perfectly capable of running the nest independently once it has been established. Its mandibles are toothed as in other species of the genus *Formica* (and all ants that are not obligatory parasites on account of hyper-specialized, toothless mandibles) and so it is able to forage, feed and nurture its brood. Its parasitism is therefore facultative, or temporary social parasitism. Although some myrmecologists have said that *sanguinea* often lives independently, in practice nests of *sanguinea* usually have 'slaves'; my own experience is that it is rare to find a colony without worker hosts. *F. sanguinea* is seen commonly foraging outside the nest alongside its host species, so that it is reasonable to suppose that there is no difficulty for *sanguinea* to infect itself with cercariae or, equally possible, to become infected by regurgitated food brought in by its host. Vogel's information that he has found *sanguinea* parasitized by *D. dentriticum* does not, unfortunately, state if this ant was found with an host species, nor whether the host species was also found to be infected.

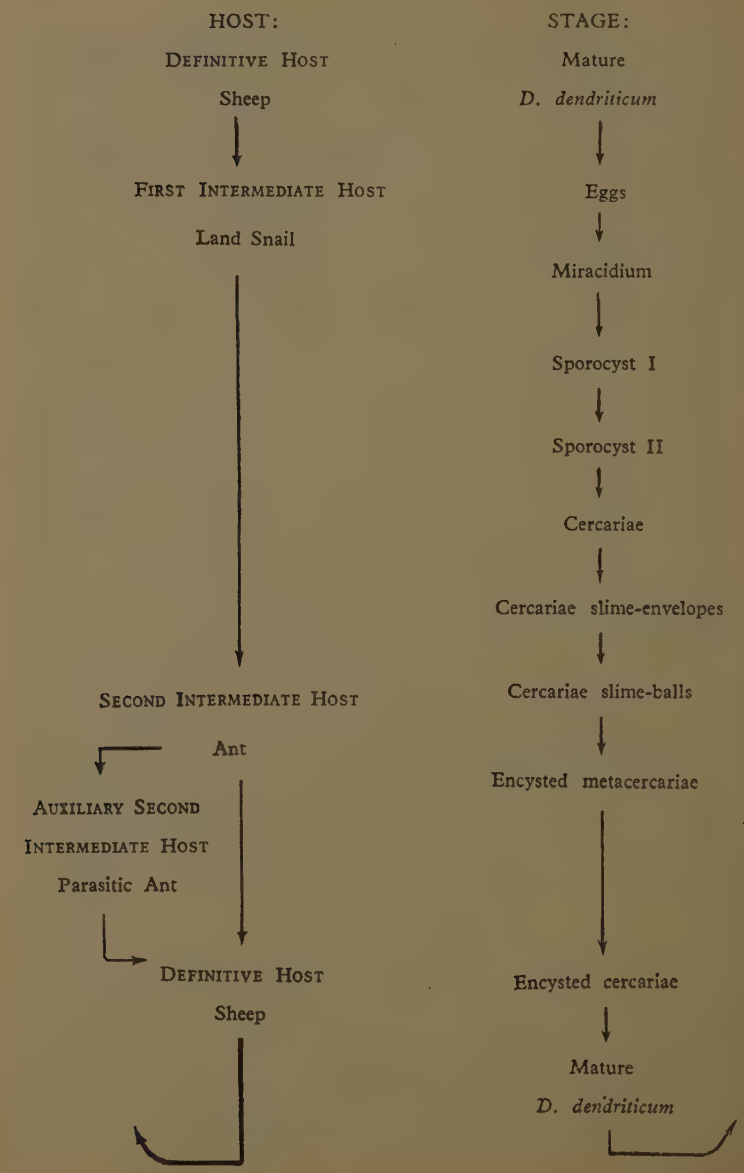
A similar kind of temporary social parasitism is manifested by *Formica rufa* L., the common wood-ant whose mounds of pine-

needles are familiar through a large part of Britain; with this species the phenomenon arises rarely, as the usual method of colony-founding is by fission from the parent nest. Here again temporary dulosis springs from the inability of the fertilized female to found a new colony unaided. She insinuates herself into a nest of an host species (usually *Formica fusca L.*), destroys the egg-laying queen, is accepted by the workers of the now queenless colony, and proceeds to lay her own eggs. The parasitized species dies out gradually, and the ants of *F. rufa* develop into a normal, self-reproducing colony.

There are other species of the genus *Formica* that form their new colonies in similar wise, and with them also, the phenomenon of parasitic colony foundation is rare; as they become pure colonies with the dying off of the host species, there arises the question of two species of ant being involved with mutual infestation of cercariae. In those instances of parasitic colony founding, infestation with *Dicrocoelium* could appear only in the period between the first hatching of the parasite workers and the final extinction of the host species, which may be estimated at not more than three years. Consequently, ants in this category of temporary social parasitism will rarely be found in nature to be concerned in any bi-myrmecine contribution to the furtherance of the life-cycle of *D. dendriticum*, partly because this social parasitism forms a minority method in the dissemination of the species, and partly because of the relatively short period in which both host and parasite will be found living together.

In a previous paper I have suggested the name *auxiliary second intermediate host* for the kind of phenomenon I have just described (in the original French text: *deuxième hôte intermédiaire auxiliaire*). It must be emphasized that this term is designed to cover only those cases of true dulosis and not those of fortuitous close proximity between two or more distinct species of ant; this latter circumstance is met with not uncommonly by virtue of a number of ecological factors which, however, bear no relationship to the motivations underlying the permanent or temporary social parasitism discussed in this paper.

The full potential life-cycle of *Dicrocoelium dendriticum* may therefore be expressed diagrammatically:


HOST:
DEFINITIVE HOST
Sheep
FIRST INTERMEDIATE HOST
Land Snail
SECOND INTERMEDIATE HOST
Ant
AUXILIARY SECOND
INTERMEDIATE HOST
Parasitic Ant
DEFINITIVE HOST
Sheep
STAGE:
Mature
D. dendriticum
Eggs
Miracidium
Sporocyst I
Sporocyst II
Cercariae
Cercariae slime-envelopes
Cercariae slime-balls
Encysted metacercariae
Encysted cercariae
Mature
D. dendriticum

The following table gives the British ants, all belonging to the genus *Formica*, which require the assistance of distinct species, also of this genus, in founding new nests. The right-hand column lists the host species, which have been compiled from the observations of various myrmecologists: —

1. SPECIES ACTING AS TEMPORARY SOCIAL PARASITES (FACULTATIVE DULOSIS) AND NORMALLY REPLENISHING HOST SPECIES INDEFINITELY.

Parasitic Species (incapable of independent colony-founding)	Host Species (capable of independent colony-founding)
Formica sanguinea Latr.	*Formica lemani* Bondroit *Formica fusca* L. *Formica rufibarbis* F. *Formica cunicularia* Latr.

2. SPECIES ACTING AS TEMPORARY SOCIAL PARASITES (FACULTATIVE DULOSIS) NORMALLY DEVELOPING INDEPENDENT COLONY AFTER ITS FOUNDATION.

Parasitic Species (incapable of independent colony-founding)	Host Species (capable of independent colony-founding)
Formica rufa L.	*Formica fusca* L. *Formica lemani* Bondroit *Formica rufibarbis* F.
Formica lugubris Zett.	*Formica fusca* L. *Formica lemani* Bondroit
Formica nigricans Emery	*Formica fusca* L. *Formica cunicularia* Latr.
Formica exsecta Nyl.	*Formica fusca* L.
Formica aquilonia Yarrow	Probably *Formica fusca* L. and/or *Formica lemani* Bondroit

(From the Continent there are records of *F. sanguinea* using *F. transkaucasica* Nasonov as host species; although the latter also occurs in Britain, its distribution and habitat make it very unlikely that a similar observation could be recorded here.[3])

[3] A note on myrmecological nomenclature is called for at this point. Yarrow has made a thorough examination of the ants belonging to the *fusca* group (Yarrow 1954), and also those of the *rufa group* (Yarrow 1955), and his nomenclature has been followed in this paper. Most entomologists will be familiar with the standard and invaluable work of Donisthorpe (1927), and, to a lesser extent, the minor adjustments made by Sweeney (1950), both of whose keys are now regarded as inadequate. The following synonymy will assist those who are familiar with Donisthorpe's (*op. cit.*) keys: —

Yarrows's Nomenclature:	Synonyms:
Formica cunicularia Latr.	*F. fusca* L. var *glebaria* Nyl., and *F. fusca* L. var *rubescens* Forel
Formica nigricans Emery	*F. pratensis* Retzius
Formica aquilonia Yarrow	*F. rufa* L. var. *rufo-pratensis* Forel
Formica transkaucasica Nasonov	*F. picea* Nyl.

In addition, Yarrow (1955) has shown that *F. lemani* a species similar to *F. fusca* in appearance and habit (though tending to nest on higher and more stony ground than *fusca*), occurs widely in Britain, and this fact had not been suspected by earlier writers.

The known distribution in Britain of *D. dendriticum* is very limited and, unless the parasite is recorded elsewhere, it is highly unlikely that many of the ant species which have been considered in the preceding pages will, in fact, be concerned as vectors in the complete life-cycle. The British distribution of the parasite is confined to the western islands of western Scotland, Tiree, South Uist, Barra, and Harris. It has also been recorded from Berwickshire, Ayrshire, and Argyllshire, but it is uncertain whether or no the infections were locally acquired. In England the only records are from the Liverpool abattoir, and Cheshire (*teste* Leiper, *in lit.* 8.1.58).

The ants concerned as vectors in relation to the above distribution of the helminth are unquestionably either *F. fusca* or *F. lemani*, although none of the records of the British distribution of *D. dendriticum* have indicated the ant species. Until Yarrow's (1954) re-examination of the ants of the *fusca* group, it would have been assumed that the vector ant was *F. fusca*. It is now recognized that both *F. fusca* and *F. lemani* exist in this country, and there is some overlap. From the island of Tiree (and Eigg as well) Yarrow (*op. cit.*) has records of *F. fusca*, but he states that *F. lemani* 'replaces *fusca* over the greater part of the British Isles, overlapping it in South and Mid Wales, Monmouth, Shropshire, Stafford, Derby, Warwick and possibly also in parts of Lincolnshire, Yorkshire, Cheshire and Lancashire, from which counties further collecting is essential before the full extent of the overlap can be appreciated'. Yarrow then proceeds to comment on the distribution of the two species in the area where *D. dendriticum* is known to occur: 'The somewhat remarkable occurrence of *fusca* on two of the islands off the west coast of Scotland (Eigg and Tiree), yet apparently nowhere on the mainland, may perhaps be explained by the probability that these islands, with Rhum, Muck and the Outer Hebrides, were not ice-covered during the third glacial phase, while the other Inner Islands and the mainland were, though the apparent absence of *fusca* from Ireland is surprising under such circumstances. The occurrence of *lemani* throughout the mainland of Scotland, in the Orkneys (Hoy Island) and on the Inner Islands of Skye and Raasay at any rate, though not on Eigg and Tiree, suggests that the species reached these parts after the latter had ceased to be connected to the mainland at the end of the second interstadial phase but well before submergence of the Islay-Inishowen landbridge in early postglacial times made entry into Ireland impossible.'[4]

[4] Collingwood, in a personal communication (1958) gives it as his view that Yarrow's source of information, leading him to conclude that *F. fusca* is found on Eigg, must be inaccurate, since the former asserts that it is *lemani* and not *fusca* which occurs there. Equally, Collingwood maintains that *fusca* is not entirely absent from the mainland. If this is the case, the assumptions underlying Yarrow's historical hypothesis may not be sufficiently clear-cut for the idea of preglacial relicts, in this context, to

A brief note about the British distribution of the other ant vectors which have been discussed in this paper will show that new locality records for *D. dendriticum* would have to be established if these ants prove to have acted as second intermediate hosts. This evidence makes it reasonable to suppose that the Continent of Europe will supply more myrmecological material in relation to the biological problems of the trematode, as not only is this latter more widely distributed there, but likely ant vectors also (in some cases) commoner there.

Species	British distribution:
F. sanguinea	Scattered localities in southern England, as far as Shropshire, and also in Mid-Perthshire and Easterness.
F. rufa	Common in many parts of southern England, spreading as far as south Wales and Northumberland.
F. lugubris	A northern species of wood ant, from Derbyshire to Northumberland; north Wales; from mid-Perthshire to Easter Ross in the Scottish Highlands, where it is locally common.
F. nigricans	Now very rarely in Dorset; an almost extinct species in Britain, though common on the Continent.
F. exsecta	An uncommon species found in south Hampshire, Dorset, south Devon, Mid-Perthshire, south Aberdeenshire, Easterness, Easter Ross.
F. aquilonia	In the Scottish Highlands from Mull of Kintyre to Sutherland; locally common in parts of Scotland.
F. rufibarbis	Only known from Surrey, and very rare.
F. cunicularia	Scattered locally throughout the southern part of Britain, reaching south Lincolnshire and south Wales.

Since, as has been said, we may look for *F. fusca* and *F. lemani* as the pre-eminent ant-vectors to *D. dendriticum,* it may be useful to quote again from Yarrow's paper in connection with the habitats of these two distinct species: 'Bernard (1946) has put on record the interesting fact that where *fusca* and *lemani* occur together in the central Pyrenees, the former nests in warmer situations than the latter to the extent that one will be found on the south slopes, the

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account satisfactorily for the present-day distribution of species of the *fusca* group. We are perhaps on firmer ground if we consider the question of insolation, since *F. fusca* is a markedly warmth-loving insect, whereas *F. lemani* tolerates lower temperatures and less sunshine. Consequently, for more immediate practical purposes, we should perhaps investigate differentiating isotherms for these two species in the geographical area under consideration; we shall in all probability find *F. fusca* in the higher, and *F. lemani* in the lower isothermal regions, granting always, of course, a considerable degree of overlap. The distribution of all the ant species in Britain may be understood in these terms, especially as ants are not primarily dependent on given subsoils (except insofar as these determine such factors as drainage). This approach complements the historical-geological one.

other on the north slopes of the mountains.[5] That they both exhibit some tolerance towards the conditions favourable to each other is demonstrated at any rate in the British Isles, in the area of overlap where the two species may occasionally be found nesting close together. On the whole, however, *lemani* will be found on higher ground, in more rugged and exposed positions, while *fusca* will be lower and in more sheltered places; these two species are perhaps only rarely truly sympatric.'

When further work is done on the distribution of these ants and of *D. dendriticum*, the distinction that Yarrow has described may prove of significance, when one considers the position of the normal sheep pastures, with their thin grass, relatively high altitude and exposed sites on limestone (which conditions are required also by the first intermediate host, the snail).

The quality of sheep grazing land has a direct bearing on the potential infestation rate from ant to sheep. The poorer the grass, the closer the cropping by the sheep, with the increased likelihood of infected ants being ingested. Also, and this can apply even on richer pasture land, when the density of sheep at pasture exceeds the optimum, there will be overcropping with increased risk of infestation.

A region which manifests all the fascinating ecological aspects of the problem is, unfortunately, not in Britain but in southern France, in Provence. There, since time immemorial, the annual trek, the *transhumance*, has taken place, which involves the driving of thousands of sheep from the Bouches-du-Rhône area some 200 miles to the Mercantour alpine pastures, from sea-level to about 6000 feet. The sheep are taken on this epic journey when the great heat of early Provençal summer scorches the poor grass of La Crau. En route to the lush mountain pastures, the shepherds are faced with the problem of finding adequate pasture when halts are made. Through the length of Provence these pastures are of necessity poor and overcrowded. Snails are known to be especially abundant in the limestone country of Provence, and some species have adapted to the intense heat thrown off the rock-face by means of extra thick shells, and they remain motionless in full sunshine for days or weeks on end. Again, the nocturnal loss of heat at ground level can be considerable in mid-summer, creating conditions of heavy dew and low temperatures. Similar but less intense conditions are met with by the sheep on their return journey to La Crau in October. Ants are far more

[5] Bernard suggests that the composition of humus is a greater determinant of distribution than is the subsoil. *F. lemani* shows a marked preference for pure calcareous schist, as this retains heat, without which the ant's altitude range would be lower, but the organic content of humus has an important bearing on colony-founding by young females. These are prone to bacterial infection in a saprophytic milieu, whereas on dry, poor soil, deficient in detritus (such as peaty, acid soil) bacterial depredations are reduced.

plentiful and diverse in species in the Mediterranean region than they are with us, so that, altogether, it would seem that ideal conditions exist in Provence for the further study of the biology of *D. dendriticum*.

Summary

Present information about ant-vectors in the life-cycle of the helminth genus *Raillietina* is briefly reviewed. The life-cycle of the lesser liver fluke, *Dicrocoelium dendriticum* Rudolphi 1819 is described. Its evolution to maturity through its intermediate hosts, snails and ants, before reaching its definitive host, usually a sheep, is discussed, with particular reference to the doubt that exists that the ants are, in fact, obligatory second intermediate hosts.

It is suggested that further rigorously controlled experiments may favour the view that ants are necessary vectors.

An outline of ant parasitism, insofar as this phenomenon is found among British species of the genus *Formica,* is given, and the theoretical possibility that a second species of ant might be concerned as second intermediate host to *D. dendriticum* is elaborated.

A table of British ants of the genus *Formica* that are temporary social parasites on account of their inability to found nests independently is given, together with the host species of ant. The view is offered that, under such circumstances, an host species of ant may infect a parasite species of ant in the same colony with the cercariae of *D. dendriticum,* and it is suggested that the second species acting in this capacity be called the auxiliary second intermediate host species.

Brief notes on the distribution in British of *D. dendriticum* and of the ants that may be concerned as second intermediate hosts and auxiliary second intermediate hosts are given.

The recent revisions in the nomenclature of British ants belonging to the *rufa* and *fusca* groups of the genus *Formica,* by Yarrow, are incorporated with the discussion on the British species concerned potentially with the life-cycle of the lesser liver fluke.

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Leaf Cottage, Possingworth Park,
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March, 1958.

REARING ZYGAENA TRIFOLII ESP. (LEP., ZYGAENIDAE)

The *Entomologist's Gazette* Vol. 9, No. 4, for October was, I think, outstanding for its three most interesting and learned articles on the somewhat neglected Zygaena genus. It seems appropriate now to submit the following notes:

On the 11th and 12th of July, 1957, I was collecting on the North Devon coast when I came across a small colony of the Five Spot Burnets in a marshy area. Three females captured showed a tendency to have the spots merged together.

In view of the date and locality, I thought these might well be the sub-species *palustris* Oberthür.

Each female produced a small batch of ova, which on hatching were kept separate.

After over-wintering, a portion of the larvae from each lot remained in the straw-coloured hibernating stage; they were slow to move about, and from the fact that at no time did they change to the usual green colour, I would judge that very little, if any, food was taken. The remainder fed up and produced imagines in 1958.

From selected pairings I now have wintering larvae, which although varying individually are, nevertheless, the same size as the previous generation now in their second larval year.

This two-year larval stage is mentioned in South, but I have been unable to find any further reference from any easily available source.

Details of the three broods are given below.

Brood No.	Number of larvae wintering first year.	Imagines.	Hibernating larvae second year.
A.	15	9	5
B.	30	17	12
C.	15	6	7
	60	32	24

During the rearing of these a larva was lost from each of the broods A. and B. and two from C.

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SUPPLEMENT TO THE LEPIDOPTERA OF GLENAGEARY, CO. DUBLIN

By E. S. A. BAYNES, O.B.E., F.R.E.S.

During 1957 and 1958, the following species were added to the Glenageary list (see *Ent. Gaz.*, **8**: 151-160).

CARADRINIDAE

Xylophasia hepatica (Hübn.). One at M.V., 20.vii.58. Regarded by Donovan as local and scarce in Ireland.

Hadena serena (Schiff.). One at M.V., 28.vi.58. Appears to be another scarce species in Ireland.

Thalpophila matura (Hufn.). At M.V., 11 and 23.vii.57.

Dasypolia templi Thunb. I was surprised to find a fine male of this species in the M.V. trap on 25.v.58. It is evidently rare in Ireland, but has been recorded once before in Co. Dublin, namely by Barrett, at the Bailey Lighthouse, Hill of Howth.

Stilbia anomala (Haw.). A male at M.V., 16.ix.58.

Meristis trigrammica (Hufn.). Frequent at M.V. Omitted from the original list in error.

Cucullia chamomillae (Schiff.). At rest on a tree trunk 22.v.57, and at M.V., 17.v.58.

Heliothis peltigera (Schiff.). Several at M.V. during the first half of vi.58. Appears to be a new county record.

PLUSIIDAE

Plusia (iota) jota (L.). One at M.V., 23.vii.57.

P. ni (Hübn.). One fresh-looking specimen at M.V., 6.vii.57. Appears to be a new county record.

HYDRIOMENIDAE

Hydriomena furcata (Thunb.). One at M.V., 7.vii.57.

Oporinia autumnata (Borkh.). One at rest on a tree trunk 5.ix.57. Apparently a new county record.

Eupithecia subumbrata (Schiff.). One at M.V., 25.vii.57.

E. abbreviata Steph. Three at M.V., 1.v.58.

SELIDOSEMIDAE

Cabera pusaria (L.). One at M.V., 26.vii.57.

Campaea margaritata (L.). One at M.V., 23.vii.57.

HEPIALIDAE

Hepialus lupulinus (L.). One at M.V., 12.vi.58. This species is much less abundant in Ireland than in England.

ALUCITIDAE

Platyptilia pallidactyla (Haw.). One at M.V., 21.vii.57.

It may be added that two more examples of *Biston betularia* ab. *carbonaria* Jordan were taken at M.V. on 11.vii.57 and 26.vi.58.

B. betularia has been much less frequent at Glenageary during the past few years than formerly. Yet ab. *carbonaria*, in an extreme form, has appeared three times between 1952 and 1958; none having been seen previously. The appearance of *carbonaria* in Co. Dublin can hardly be accounted for by industrial melanism. Melanic *betularia* was first recorded from the county by Dr. A. A. Lisney, who bred two specimens from wild larvae obtained at Shankill in 1938. Donovan refers to earlier records in Cos. Louth and Down, and, in recent years, it has been taken in Co. Antrim by Capt. W. S. Wright. Evidence seems to point to *carbonaria* being on the increase in the eastern counties of the northern half of Ireland.

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THE RHOPALOCERA OF FARTHING DOWNS, SURREY

By T. R. L. BIGGER

The following list is a record of the butterflies observed or caught by myself and my brother over the past ten years in this north-eastern part of the North Downs. The area in question is a strip of downland three miles long by one mile wide, which is typical of chalk downs, being mostly open grassland with a few trees and shrubs, but there is a wooded area at its southernmost extremity. Farthing Downs are situated just south of Coulsdon, Surrey, on the northward approaches to the North Downs, and is the first tract of open country to be met with as one proceeds south from London down the Brighton Road.

The downs are very close to a vast residential area, but even so they hold a very interesting butterfly fauna, with twenty-eight resident species. This number plus common and rare visitors brings the total number of species observed on the downs and in the woodland to thirty-five.

LIST OF SPECIES

SATYRIDAE

Maniola jurtina (L.)	Very common.
Coenonympha pamphilus (L.)	Very common.
Pararge aegeria (L.)	Very common.
P. megera (L.)	Common.
Eumenis semele (L.)	Occasional visitor.
Aphantopus hyperantus (L.)	Common.

NYMPHALIDAE

Argynnis aglaja (L.)	Fairly common.
A. paphia (L.)	Very few.
Euphydryas aurinia (Rott.)	One seen in 1950.
Nymphalis io (L.)	Fairly common.
Aglais urticae (L.)	Common.
Polygonia c-album (L.)	Fairly common.
Vanessa atalanta (L.)	Fairly common.
V. cardui (L.)	Common in some years.
Limenitis camilla (L.)	Small colony in wood.
Nymphalis antiopa (L.)	One seen in 1949.

LYCAENIDAE

Callophrys rubi (L.)	Fairly common.
Thecla quercus (L.)	Few in woods.
Strymon w-album (Knoch)	Small colony in wood.
Cupido minimus (Fuessly)	Not common.
Lysandra coridon (Poda)	Common.
Aricia agestis (Schiff.)	Common.
Polyommatus icarus (Rott.)	Very common.
Celastrina argiolus (L.)	Fairly common.
Lycaena phlaeas (L.)	Common.

PIERIDAE

Pieris brassicae (L.)	Very common.
P. rapae (L.)	Very common.
P. napi (L.)	Common.
Euchloe cardamines (L.)	Common.
Gonepteryx rhamni (L.)	Very common.
Colias croceus (Geof. in Fourc.)	Few most years.

HESPERIIDAE

Erynnis tages (L.)	Common.
Pyrgus malvae (L.)	Fairly common.
Thymelicus sylvestris (Poda)	Common.
Ochlodes venata (Br. and Grey)	Common.

A few other species not found at this locality are nevertheless found in abundance in other haunts on the North Downs only a few miles away:

Maniola tithonus (L.) — *Lysandra bellargus* (Rott.)
Argynnis euphrosyne (L.) — *Thymelicus lineola* (Ochs.)

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EUPETHECIA OXYCEDRATA (RAMB.) IN GUERNSEY (LEP., GEOMETRIDAE)

On 21st August, 1958, I captured at light an unfamiliar Pug, which later the British Museum of Natural History identified as *Eupethecia oxycedrata* (Rambur). This is the first recorded occurrence of this moth in Guernsey; it is, I am informed, a Mediterranean species originating in Corsica.

'Casa Mia', Stanley Road,
Guernsey. C. J. SHAYER.

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